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PRÆLECTIONES *Pharmaco-mathicæ*
& *Medico-practicæ*:

BIBL
OR,

LECTURES
ON THE
RATIONAL E
O F
MEDICINES.

In TWO VOLUMES.

CONTAINING

All that is necessary for knowing the Virtues of
Drugs already discovered, or that may here-
after be found out.

IN WHICH

Are inserted all Simple and Compound Medicines
now in Use, and their Operations clearly stated.

*Read to Pupils, and communicated to the Publick
for the Use of young Practitioners.*

By *EDWARD STROTHER*, M.D.
Coll. Christ. Cantab. & Coll. Med. Lond. Reg. Colleg.

L O N D O N :

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T H E

P R E F A C E.



HE following Sheets are a Course of Lectures, which were read to young Gentlemen; who will be glad to see them published; The more Advanced in the Study of Physick don't stand in need of them; and they who have applied little to this Art, may have them more fully explained to them occasionally, as indeed there is a Necessity, if they design to be expert in their Profession.

I have made use of all the Sorts of Demonstrations to prove the Virtues of Medicines; because, where I could, I have proved the Effects

iv The P R E F A C E.

Effects from the Cause, the Cause from its Effects, and the Nature of them by their Properties, and vice versa, which last Sort of Proof I have principally made use of, because the Nature of the Thing generally admits of no other.

I hope it will not be thought I have dwelt too long upon the Subject, since it is so useful.

By such a Method only we shall be able to account for the odd Effects of the Water of the Lauro-Cerasus, and how a Poisón is made into a nourishing Bread; as also to make a true Renunciatio, so much wanted, besides many other Conveniences too long to mention.

But I shall not detain the Readers any longer, only refer them to the Book itself.





P R A ELECTIONES
Pharmaco-mathicæ & Medico-practicæ:
 Or, A COURSE of
 L E C T U R E S
 ON THE
 RATIONALE of MEDICINES, &c.

P A R T I. B O O K I.



HE Design of these Lectures is to search out from the Vegetable, Animal, and Mineral Kingdoms whatever may be conducive to the Health of Mankind: And as there is such a vast Variety of Subjects to be enquir'd into, all which must be thoroughly examin'd by an accurate Scrutiny, the Labour is great, and the Undertaking tedious.

However, as Order is convenient in so grand a Work, for avoiding unnecessary Excursions; I shall suppose a great many Qualifications, without giving

giving a larger Detail of all the Knowledge we have acquired from Chymistry and Natural Philosophy, than is found of Use to remind us of those Acquisitions.

This will give us to understand how slenderly some Men must be vers'd in this Art of the *Materia Medica*, when they gather the Virtues of Medicines from no other Information than from the Prescriptions of the Gentlemen of the Faculty upon the Files, and so are equally skill'd in this Point with the Apprentices who relate the Cases in which they were order'd.

And as the present Practice is reduc'd to so narrow a Compass of Drugs, that it were not difficult for a Person of a moderate Genius to compile a *common Place* in a Fortnight's Time, and to be Master of it in as much more; thus the Profession cannot fail to abound with Empiricks, and to be liable to fall into the Hands of Men of the lowest Capacity.

To avoid this Imputation, I have thought fit to rescue this noble Part of Physick from such Abuses, and to endeavour at reducing it to a scientifick Art; in which nothing shall be asserted that is not supported with Experiments, nor shall any Experiment be try'd without essaying at a *Rationale* for it. How far I may fail in the Attempt, you, my Hearers, will be Judges.

However, the Labour I take upon me will never be reputed fruitless by you, because it will incite you to farther Inquiries, when I am said to be at a Loss, and all of us will become the wiser and more learned thereby, and our Views will reach beyond the above-mention'd narrow Limits.

But that I may not detain you from the main Scope of these Inquiries, I shall premise some general Heads, which are previously necessary to the Body of the Lectures themselves, and which serve

serve as a Basis to build the whole Structure upon.

The Art of Physick deals in sensible Objects ; and therefore we shall give ourselves very little Anxiety concerning the Principles of the Peripateticks, that are bandy'd so strenuously among them, to wit, that there is a *first Matter* common to all Bodies, which we neither can nor do deny ; the Proofs for it are evident, or we must grant Annihilation naturally possible, and this would be assuming a Power that Omnipotence reserves to itself. I then suppose that you have used yourselves to these Conceptions in Schools, and therefore shall give you no farther Trouble on this Head.

This Matter being cloath'd with essential and accidental Properties, leads us into the Knowledge of all we wish or aim at in our present Inquiries ; those Properties are call'd *essential* which any Body always collectively enjoys ; v. g. so long as Gold remains of such a specifick Gravity, of such a Colour, of such a Ductility, of a certain Fixity, indissolvable but by *Aqua Regia*, and so forth, so long it retains its essential Properties, and so long it is call'd *Gold* ; and those are call'd *accidental*, which no way alter the essential ones : Thus it is no matter of what *Figure* Gold or Wax be of, they will notwithstanding remain to be Gold and Wax. The Change therefore of essential Properties destroys the Subject, but accidental Changes do not : From Matter therefore variously modified infinite Changes are produced, as will appear to you in the Sequel of these Lectures.

To Matter appertain *Extension*, *Mobility*, *Resistance* or *Gravity*, and *Figure* ; it is *divisible in Infinitum*, and *impenetrable*. These Properties are so stable, that no Matter wants any of them ; it is extended, movable, heavy, has some Figure

or other, may be divided into minute Parts, and its Dimensions cannot be penetrated : Some contend that Extension is its Essence ; be that how it may, all Matter whatever enjoys all these Properties, and at all Times : They are Properties *quarto modo*, as Logicians term them, and agree *omni, soli & semper*. There are other Properties which Matter has, that are also proper to all Matter, which Matter alone enjoys, but every Matter has different Kinds of them ; they are proper *tertio modo*, according to the aforesaid Logicians, *sc. omni, soli, sed non semper* ; that is, they agree to all Matter, to Matter alone, but not always.

To illustrate what I have said, it must be observ'd, that there is no Matter that can be named which is not impenetrable, divisible, movable, extended, figured and heavy ; but then all Matter is not of an equal Texture, nor under equal Contacts, nor placed in the same Order, or has the same Bulk, Figure, Gravity, or Position ; that is, altho' there is no Matter without these, yet they are different in all, one Body having one Texture, another a very different one ; one Body is placed at a great Distance, another at a small one, and so forth.

The first Properties therefore of Matter are as to their general Notion invariable ; but the latter are mutable, so that they are really never the same in different Species ; for Example, Gold and Lead are always extended, heavy, divisible *in Infinitum*, impenetrable in their Dimensions, movable, and figured ; but then the Texture of Gold differs much from that of Lead ; Gold is closer than Lead ; the Particles of Matter in Lead are placed at a greater Distance from each other than those of Gold ; their specifick Gravities differ, and they have not always the same Figure, tho' they can't want some ; they are not always of the same Bulk,

Bulk, altho' they never want some; nor can one Piece of Matter be so easily moved as another, tho' all is movable; nor is one Body so readily divided as another, tho' all are divisible *in Infinitum*. *Impenetrability* only is invariable, because that would otherwise imply a Contradiction, to wit, that if Lead were in the same Place with Gold, Lead would be there, and would not be there.

Extension therefore, Divisibility, Motion, Figure, Gravity, &c. are included necessarily in the general Notion of Matter; but they vary in Particulars: they are necessary and immutable Properties; but are contingently variable: Impenetrability only is really and negatively immutable, because Matter is always and invariably impenetrable.

From these several Heads, adding the Order, Distance, Position, and Texture of Bodies, we shall deduce all that is necessary for Physicians to know on these Lectures.

As for *Extension*, it becomes us to make Inquiry into the complete Dimensions of all Bodies that offer themselves to our View. This, however, includes a Necessity of Skill in Geometry; the Knowledge of which has caused a bright Addition to the Art of Physick: The wise *Hippocrates* advised *Thessalus* to apply strenuously to the Science of Numbers and Geometry, as useful Embellishments, both for Mankind in general, and for Physick in particular. But this Science having received such prodigious Advancements of late, it becomes now absolutely necessary for a Physician who would aim at the *Rationale* in Physick, to have a tolerable Skill in it, because it reaches the Solids, the Fluids, and all their Motions. I cannot deny but it bids us adieu in the Practice; but then it is succeeded by the Experimental Philosophy and Chymistry, which lead us into the

Principles of Bodies ; and these again lead us into the Knowledge of all the Changes which our Fluids and Solids undergo ; we are as surely inform'd of the mutual Operation of Fluids upon Fluids and Solids, and of the Effects of Medicines upon us by Trials, as we are of the Magnitude of any Body by taking its Dimensions. If these two Studies will be made to go Hand in Hand, scarce any Difficulty can escape our Comprehension : But I must here observe to you, that it has been hitherto too evident, that the former have acted with Contempt towards the latter, and must therefore have fail'd of being so serviceable to Physick as they might have been ; the Difficulties they founder'd under in Practice have at length given them to see their Error, and they who are to succeed will reap the Advantages of the Labours of both ; without both of which, nothing great will ever be done.

When I speak of *Extension*, I don't always mean Matter extended : I would be understood to speak also of that *Mode* of Matter, which is a real Property of it, distinct from Matter ; for Extension is not always Quantity, nor a solid Body ; neither mathematical Points, for Example, out of which mathematical Lines are made, nor such Lines composing mathematical Surfaces, neither yet such Surfaces composing Quantity and Bodies, are Solids ; they are only *Modes and Affections*, having real Properties : So neither are Angles, Quantity or Matter ; they are only a *Mode* of Inclination, or an Affection of Matter. Who calls an extended Shadow Matter ? And yet all of these are capable of Mensuration.

I don't know how properly *Time* and *Velocity*, out of which Spaces are made, may be ranged under Extension ; but as they are mensurable, they have a Place here.

As to the *Figures of Bodies*, we may say, that they greatly contribute towards the Difference in the Operations of Medicines: Thus

Globular Figures are more readily moved all Ways than any others.

Spherical Figures cohere less than other Figures, their Points of Contact being fewer.

The less are the Surfaces of Bodies, the greater is their Velocity under Motion, or the less is their Retardation.

The obtuser are the Angles of Bodies, the less do they hurt. Therefore

The acuter are the Angles of Bodies, the more they hurt.

For the less are the Bases of Bodies, and the larger their Radii, the deeper do they penetrate into Bodies; in which Case they resemble Wedges.

Hence if any Bodies are like Wedges, that is, conical and hard, and are driven forward with any great Impulse, they cannot fail of turning Poisons to those that take them. Thus Sublimate or any metallic Crystals, that are made with a pure acid Spirit, must be very caustick and poisonous; the Metal they are loaded with gives them Weight, and their acid Spirits having Points which with a small Heat and Moisture are put into Motion, a small Impulse makes them act with an invincible Force, their Power being so vastly superior to the Resistance made against them; this being in a compound Ratio of the Hardness of the Points, their Lengths, their Smallness, their Weight, and the Velocity with which they are born against the Body, whose Resistance is so small: Thus it is not easy to corrode Bones, but no difficult matter to consume Flesh.

We are not sure whether the Figure is not the Cause, why Mercury amalgamates with Gold, Silver, Tin, Lead, and Sulphur: The Pores of these Bodies are of such a stated Size as to admit of Entrance. A weak acid Spirit will dissolve Lead, which a stronger will not touch. There must for that Cause be an Aptitude of Pores in the Lead to receive the weak Spirit only: And this appears the more likely to be the Case, because if we pour in so much Water as will bring the strong acid Spirit down to the Weakness of that which dissolves the Lead, it will then prey upon the Lead also.

It is owing to the Figures which Bodies, in some measure or in part, have, that they are solid or fluid: For as the Notion of a Solid is, that it touches in many Points, and of a Fluid, that it is spherical, and therefore touches in few; their Change of these States depends on their Changes of Figure: Mercury affords an Example of both, for it is a solid Fluid, and the component Parts of all Fluids are solid; for Water is less ductile than Gold, and is incompressible, so as to sweat thro' any Metal: and that Property which we find in Water of freezing, shews us, that upon the Figure of the Particles being changed, it becomes solid.

Cohesion therefore being only owing to the Shape and Figure of Bodies, when the Blood grows cohesive, as it does in phlegmatick and rheumatick Cases, the Globules of it must be changed from spherical to plainer Surfaces, and must touch in more Parts; and this is done by the various Salts, that change their Figures.

Hence it follows, That spherical Bodies are more readily sublim'd; for as they touch in fewer Parts than any other Figure, any Impulse

pulse raises them. This is the Case in Quicksilver, which flies off by any gentle Heat.

Congruity arises from the Figures of Bodies fitting each other, and Incongruity from the contrary.

The Figures of Salts produce various Changes, by making various Impressions on our Palate, and therefore Tastes depend upon various Configurations of the chymical *Principles* and *Principiata*.

The Figures of Crystals serve to distinguish one Kind from another ; and these Figures are very constant and univocal ; so that some are always hexaedral, others pyramidal, or rhomboidal, &c. Thus *Nitre* runs into hexagonal Prisms, or Pyramids ; *Sal Marine* into Cubes ; *Borax* (Tincal) into prismatick Glebes ; imperfect Vitriols into Rhomboids ; *Salt Gem* into prismatick Cubes ; *Sal Armoniac* into Hexagons ; Alom into an Iso-he-drical Figure ; perfect Vitriols into decagonal Rhomboids ; from which Figures it is easy, upon Sight only, without tasting, to know any Salt crystalliz'd : And what is yet more observable, each Salt attracts its own Kind.

As a full Proof that Cohesion is not an Effect of Gravity, I will give you two Instances ; first, Diamonds are much lighter than Gold, yet they stick closer together than Gold ; secondly, Oil is lighter than Water, yet it coheres more strongly ; and I cannot but think, the *Areometer* does not simply indicate the specifick Gravity of Bodies, but both the Gravity and Cohesion of them together. Chymists have always affirm'd, that Sulphurs are the Cause of Cohesion ; for when that is extracted from Bodies, they crumble into Atoms.

Impenetrability is another essential Property of Matter: All Penetration is apparent only, namely, is made only thro' the Pores of the Body. Thus Steel, or any Body on Fire, is only Fire lodg'd in the Pores or Vacuities of the Steel. Fire is so subtile a Body, and so capable of entring by its swift Motion and minute Parts into all the Pores of any Matter, that it penetrates them suddenly; but this does not disprove the Impenetrability of Matter. The Pores of a Pumice admit of Water, but not of all Salts; whereas Fire enters any Pores: And if the Impulse of Fire conquers the Resistance of Matter, the Body mounts into the Air.

Divisibility is another essential Property of Matter; for all Matter is capable of it, so long as it is Matter. These following Affections of it are well known; *viz.*

That tho' Magnitude be finite, yet the Number of Parts are infinite.

That an Infinite may be adequately to a Finite, to wit, that an infinite Series of Numbers decreasing in any *Ratio* may be made equal to a finite Number; for Example, that $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$, are equal to 1: Thus, the *Ratio* (2) divided by the first Term less one, is equal to the Sum required; or, as Algebraists mark it, $r a \div r - 1 = s$.

That Gravity decreases in a triplicate, but Surfaces only in a duplicate Proportion, and therefore whilst the first decreases so fast, and the latter so slowly, the Surfaces of smaller Bodies with respect to their Contents, are larger than the Surfaces of greater with respect to their Surfaces; for suppose two Spheres were given, one of which has a Diameter of two Inches, then the Surface of

of that Body would be 4 Inches, and its Quantity of Matter would be 8; another has 4 Inches Diameter, its Surface is 16, and its Contents are 64: Now 64 is but $\frac{1}{4}$ of 16; but 8 is $\frac{1}{2}$ of 4; therefore smaller Bodies have larger Surfaces than greater, if we respect their Contents. Hence is it that a Lump of Gold will immediately sink in any Liquor, whilst this Lump put into Powder will swim; but it swims, because Resistance, that is, Retardation, is as the Surface; wherefore the larger is the Surface, the flower will it descend.

That Division causes Salts to act; for *Salia non saliunt nisi soluta*: And this is a necessary Condition in all Cases, where Bodies are to be fermented or putrefied; and therefore in Digestion, Chylification, Sanguification, and Secretions of all Kinds, it is necessary that the heterogeneous Particles should be divided into their integral Parts, in order to perform all the Functions of Life.

That Division of Bodies into Parts is sometimes convenient, and often hurtful; for where we want to have a Body to touch in many Points, as in exciting Vomiting, or the like, Powders or Tinctures are proper; but where the Force of a Remedy depends upon its Figure alone, as in Glass and *Calomel*, then Comminution is improper; for Glass powder'd small may be taken without any Detriment, and is commended in the Stone by some Authors, and Calomel or Mercurius Dulcis finely powder'd, do not stimulate the Stomach so much, and therefore neither of them purge much when so order'd.

Quantity of Matter, or Gravity, or the Weight of Bodies, is another universal Property of Matter ; it acts constantly and in the same Manner, unless the Quantity of Matter be increased or diminished. Hence its Effects or Qualities are not changed, unless the Weight be changed : So that if Qualities are owing to Gravity alone, if the same Quantity of Matter remains, the same Effects will be produced. We know the Effects of Gravity, altho' we know not the Cause of it ; for Example, we know,

That heavy Bodies do tend towards the Earth's Centre ; the Removal of which by the Omnipotent Power would cause a Deluge.

That we denominate this Tendency, *Gravity*, or a Power of gravitating.

That the Exercise of this Power is call'd Gravitation and Attraction. 'Tis a Power, because it presses against all Obstacles, and its Actions are in a compound Ratio of its Intensities and the Spaces run.

That this Gravity, with respect to Bodies, is call'd Weight.

That this Weight is proportionable to the Quantity of Matter in Bodies.

That *Density* is this Weight with respect to the Bulk ; or 'tis a greater Weight under a less Bulk ; and this is call'd *specifick Gravity*.

That *respective Gravity* is the Excess of Gravity of any Solid in respect of any Fluid 'tis suspended in.

That *absolute* and *specifick Gravity* are in the same Proportion, to wit, as the Weights of equal Bodies with respect to their Bulk, and the Densities are inversly as the Bulks.

That Gravity acts near the Earth equally every Moment of Time, that is, every Moment adds a new and equal Impulse, so that the

the Fall of Bodies is as the Squares of the Times in which they fall.

That centripetal Forces are inversly as the Squares of the Distances, that is, the higher any Body is, or the more removed it is from the Earth's Centre, the less swift is its Fall. Hence Pendulums must be made shorter at the Equator.

That Resistance is a Cause of the Slowness of Descent, because Gold and Feathers, which are of very different Densities, when the Air is exhausted, fall together.

That the lower you descend, or the nearer Bodies are placed to the Centre, the more weighty they are; and the higher they are, or the more removed they are from this Centre, they weigh the less.

That centrifugal Force increases as the Pondus or Quantity of Matter or Gravity; so that when Bodies revolve with any degree of Velocity, they fly off the furthest which are heaviest: A Ball is therefore carried further from the same Gun with an equal Charge, than a Slug; for Resistance is equal to the Difference of the Weights between Bodies moved; and altho' a Ball is more retarded than a Slug, yet it conquers the Resistance better; Retardation being as the Square of the Diameter, but Resistance as the Cube of the Quantity of Matter: It is for this Reason that if we whirl round a muddy Bottle of Wine, it soon grows clear.

That Friction is a great Cause of Retardation.

That Resistance is equal, where equal Portions of a falling Body are struck.

That *Opposition* is inversly as the Velocity of a striking Body, or directly as the Time, as in the Case of a Ball falling upon Paste, Clay,

Clay, Jelly, congeal'd Milk, or Silks placed in parallel Laminæ : The Velocity and Matter conquer all Opposition.

That Precipitation is caused by Gravity conquering Attraction ; so that the Gravity of the Menstruum being increased too much, the Body suspended does not fall ; but the Gravity of a Body being increased, or the Menstruum being decreased in Gravity, the Body suspended falls.

That all Bodies do contain Pores or Vacuities void of Matter, which cause the various specifick Gravities ; and that Rarefaction makes Bodies lighter therefore.

That Gravity hinders Ascent naturally, and therefore heavy Bodies do not readily ascend, unless some other Cause does concur.

That Gravity is not the Cause of Liquefaction, because some heavier Bodies melt sooner than lighter ones, as Lead sooner than Copper.

That Bodies grow laxer or rarer, when the Weight is absolutely increased, but decreased specifically ; as it happens in Crocus Martis and Iron, the latter of which is specifically heavier, but the former is absolutely heavier.

That as the Diameter decreases, so does the Gravity ; and *vice versa*, in a triplicate Ratio.

That Præcipitation is a Separation of Bodies united by Attraction.

That Bodies are sooner or later dissolved according to the Magnitude of their Pores, as one Cause.

That there is a certain Proportion to be observed as to the Quantity of Matter in Solutions, because Liquors will dissolve a certain Quantity, and no more : And hence is

is the Dose of the Solution of Crocus Metal-lorum to be estimated from the Quantity of the Dissolvent, and not from the Quantity of the Powder infused.

That it is easy to account, why Bodies should be dissolved in a Menstruum equally heavy with these Bodies ; but how heavier Bodies should be suspended, or lighter not emerge, is a difficult Problem to solve : However, when heavier Bodies are divided into larger Surfaces, so that their *Resistance* equals the **Gravity**, or when lighter Bodies are strongly attracted, both will be suspended or detained ; for Decrease of Weight attends the Increase of Surface : Thus Gold in Powder swims, but in the Lump subsides ; so that Pulveri-fation decreases Descent ; and Gold infused with volatile Salts flies into the Air.

That Emersion is a Sign of Gravity decreased.

That the Quantity of Space, in the Pores, is much greater than the Quantity of Matter in Bodies.

That Bodies very light are retarded sensibly by the Resistance of the Air.

That Resistance from Matter is proportionable to the Quantity of Matter ; and this is call'd *Inertia*, or *Vis Inertiae*, or Inactivity ; for Matter cannot move itself.

That a greater Inactivity requires a greater, and a less requires a less Force to over-come it.

That a Solid, tho' floating, increases the Pressure on the Bottom of the Vessel ; therefore living Fish swimming, increase the Pressure.

That a Body immers'd in a Fluid, loses so much Weight in it, as its Bulk of that Li-quor in which it is immers'd, weighs.

That

That *Attraction* of Gravitation, or a Tendency of one Body towards another, such as is that of the Moon towards the Earth, and of the Earth towards the Moon, is always proportionable to the Quantity of Matter in the attracting Bodies *directly*, and to the Distance *inversely*; that is, the greater is the Quantity of Matter in the Sun than in the Moon, the more does it attract the Earth than the Moon; but the greater is the Sun's Distance from the Earth than the Moon's, the less does it attract; for Attraction increases with the Quantity of Matter, and lessens according to the greater Distance. Observe here, that I speak of the universal Attraction of Matter, and not of the *Attraction of Cohesion*, which does not at all increase in Proportion to the Quantity of Matter; for Bodies do not cohere the more strongly, because they are heavier specifically.

Mercurius Dulcis cannot be suspended in Water, unless it be boil'd in Lime-Water; for then the Liquor being heavier, altho' what makes it so be a Precipitant of Mercury dulcified, yet its suspending Power conquers its precipitating Force.

Perhaps *Goodin's* Drops are this Preparation.

Weight acts as a Deobstruent in many Cases, and increases the Blood's Moment.

Proportion is nicely to be observed in Experiments; for Example, 3 Drops of Aqua-fortis will not effervesce with 6 of Spirit of Wine rectified, but 8 will.

Silver is not precipitated out of Aqua-fortis without a large Quantity of volatile Spirits; when Copper is thrown down out of Aqua-fortis by volatile Spirits, if we put in a just Quantity of these volatile Spirits, the Liquor turns green; if too much, blue, &c.

M O T I O N.

By Motion, I only mean the Power of being moved, which is a Property essential to Matter; when this Power is reduced into actual Motion, the Exercise of the Power is occasion'd by an Impulse, which is external to the Body moved, and yet this Motion has certain Laws, which are known and fixed: Thus centrifugal Forces are determined.

As to Motion *in Abstracto*, in Power; or *in Concreto*, in Act; the only useful Consideration of it is when we endeavour to determine its Quantity.

All Changes are made by Motion; that is, by one Body acting upon another. It is either increased or diminished: Thus if Acids are kept for a considerable Time, they grow mellow; because they, for the most part, contain a latent Oil in them, and they grow sweet, by reason the Acid attracts this Oil, and joins in with it, and both strictly united, cause a Sweetness; as you will see by Experiments in the *Second Part*. Thus it is that Brandy mellows by Age.

Attraction is an Effect of Motion, which happens when two Bodies are placed near to each other, or within the Sphere of Attraction.

On A T T R A C T I O N o f C O H E S I O N and M E N S T R U A.

We can reason upon many Points in Physick by *Analogy*; but Attractions admit of no such Proceedings; for Materials of equal Gravity, of like Structure, of similar Parts, and indeed alike in most Affections, will yet differ widely in Attraction; which depends on a determinate Quantity of attracting Particles, whatever they be; and without descending to many Particulars, the same

Material will gain, retain, or lose its attractive Quality by a Change of Position, by Percussion, by Comminution, or by any slight Alteration im-press'd on it. For Iron is known to turn magnetical barely by standing for a long Space of Time in a perpendicular Posture; a Loadstone loses its attractive Force by being reduced into Powder, or by being too vehemently beaten upon an Anvil; it is experienced also, upon breaking a Loadstone, that there is often found one Piece of it which has a greater attractive Power than the whole united Stone had. In this one Particular of Attraction, Experience is our only Guide; and it is by no means safe to reason on this Point, as we do on others, which admit of Comparisom, with great Uniformity, as all Men of Skill have ever granted; for if *Steel* operates by its Gravity in opening Obstructions, this Conclusion has never been denied, to wit, that *Mercury* will act more powerfully, because it is specifically heavier; or, if *Vinegar*, as an Acid, arrests the Blood's Motion, it has always been allowed and granted by Physicians of all Sects and Denominations, that *Oil of Vitriol* will, being a stronger Acid, produce this Effect more quickly and more efficaciously, even to become a Poisom, that will cause a total Stagnation; or again, if *Earths* impregnated with gentle *Acids* become milder Stimulants, and if the gentlest Stimulation is found to shut up the Mouths of the Vessels, it has always been granted and experienced, that all sorts of Earths thus impregnated will produce like Effects, whose Degrees differ, as the Affections of the different Materials vary; and it is as certain, that heavy Earths, which have imbib'd strong Acids, do become at last caustick with regard to the Solids, and congealing with respect to the Fluids, and are therefore dangerous Poisons.

It is very true, that the Effects of Medicines were at first casually discover'd; but the frequent Use of them has now taught us the Seasons, the Quantities, and the Manner of administering them; must we never therefore venture out of these Trammels? Is it not a commendable Diligence to attempt at a *Rationale* in Physick, where Experience, our Guide, our Mark, and our Leader, is always kept in View, is never thwarted, and is drawn into settled and undeniable Axioms, for the Ease of Students, and the universal Benefit of Mankind? Surely a Refusal or Contempt of this Industry favours too much of Indolence, and is too evident a Mark of Design against the Improvement of our Youth, and is a Discouragement to all Application: In short, if certain Rules are not settled, and Maxims are not truly stated, the Brangles in Physick will never have an End. Experience alone, according to these Gentlemen, being our only supposed Guide, it will always be found precarious, according as the Persons will have varied from each other in their Observations: And how often do we find two agree in difficult Cases? On the contrary, each boasts of his Experience, and prefers his own before his Assistant's; and where there can be no settled Maxim, in which both may agree, as in this Supposition there would not; then think in how miserable a Case Patients are, where they must run the Risque of trying contrary Methods before they can regain their pristine State of Health.

As these Attractions then are various and numerous, I shall take the Liberty to descend to some of the most considerable, that we may not be at so great a Loss, as to be ignorant of them, or at too much Pains in turning over Volumes to arrive at their Knowledge.

Lead is best dissolv'd by weaker Acids, and therefore if we are inclined to dissolve it by stronger, such as Spirit of Nitre, or Oil of Vitriol, they are first to be weaken'd with adding Water to them.

Red Mercury precipitate is dissolv'd by Oil of Vitriol ; which, however, will not touch Quicksilver, unless they be boil'd together.

Iron attracts Acids powerfully, and therefore any Preparation of Quicksilver, by adding Iron in Filings and calling it over the Helm, revives into running Mercury : In like manner, if we calcine *Allum* in an Iron Vessel, the Acid of the *Allum*, by which it becomes in any other manner corrosive, is so imbib'd into the Iron, that it is not then a Cathæretick.

If *Æthiops Mineral* be sublim'd along with Iron Filings, the Mercury comes over the Helm reviv'd, because the Sulphur is more attracted by the Iron than the Mercury.

If Vermilion or Cinnabar, whether native or artificial, be mix'd with Lime or any other fix'd Salt and sublim'd, the Mercury mounts and revives ; which proves that the fix'd Salts and the Sulphur do attract each other more strongly than the Quicksilver and Sulphur do.

Acid Salts do less attract Water than do fix'd or volatile Salts, and therefore *those*, when exposed, don't so readily run *per deliquium*, and melt as *these* do.

Metals dissolv'd in acid Spirits are precipitated by alcaline Bodies (fix'd or volatile Salts) because acid Spirits do attract Alcalines beyond Metals ; and when these Metals are once precipitated, they may again be dissolv'd, because when the alcaline Parts are overcome by the acid, the Metal is again attracted as before, or the Attraction recommences.

Fix'd

Fix'd Salts attract Water first, and then the Oils ; as we see in making Soap, where the Water is attracted by the Salts and flies off, and then the Oil joins in with the Salts, and thickens by the Fire ; as appears in rectifying Spirit of Wine with Salt of Tartar.

Acid Salts attract Water more than Water attracts itself ; because there is a greater Quantity of Matter in Acids than in Water.

Aquafortis or Spirit of Salt attracts a yellow Colour, before a blue ; because a green Cloth upon pouring a little of either of these upon it, turns blue ; for as blue and yellow make a green, if the yellow be attracted by these Spirits, the Cloth becomes blue again.

Acid Spirits do attract alcaline Salts before Oils, and therefore in Distillations Oil of Vitriol makes the Oils that are join'd to alcaline Salts very pure.

From this Attraction we learn why the cold Fit of an Ague or Fever precedes the hot one ; for hot Ebullitions are always between Oils and Salts, whereas the cold ones are ever made between Salts and Salts : Now as acid Salts do first attract the fix'd or volatile Salts before they attract the Oils, the cold Fit always begins first. Thus somewhat like a Mixture of Sp. Alum and volatile Salt Armoniac will settle the Liquor in the Thermometer ; and such may readily happen in the Blood ; hence some thirst after Acids, from a warm Ebullition, but at last the Oils and Acids meet, and then a lasting Heat ensues.

Earths do attract Oils more than volatile Salts ; and hence is it that in the Sublimation of volatile Salts, that are generally yellowish, from their Oil adhering to them, any Earths, such as Chalk, Bole, Lime, or such like, being added, do suck up the Oil and retain it at the Bottom, and the volatile Salts mount and become white as Snow.

Blue Vitriol wetted with Spittle and rubb'd upon a Knife, gives a red Mark, which shews that the Spittle contains some alcaline Salts precipitating the Vitriol and making the Copper attract the Iron.

Acid Salts do more readily attract fix'd than volatile Salts; and hence do we acquire volatile Salts out of Neutrals, by adding fix'd Salts to them, even without a Fire, which proves that fix'd Salts are more alcalious than volatile ones.

Acids do first attract Salts and Earth, and last of all do they attract Oils: Hence happens it that Fruits are first harsh and acerb, and become mellow and sweet at last.

Earths and fix'd Salts do attract Acids, and therefore do these Things take off Empyreuma's from the Oils: It is by these Bodies thrown into Stills, by Distillers, that they are come to a great Perfection in making *English* Spirits resemble *French* Brandies, by which Artifice some have of late acquired Riches.

Fix'd Salts do attract the Sulphurs and Acids in Sea Salt, and make Earths approach nearer to each other, so as to become a Solid when remov'd from the Fire; as appears in making Glafs out of Sand; the Fire communicating a repelling Force to the Particles of the Glass, the Sand sticks together so long as the Distance to which the Fire drives its Particles from each other, is less than the Sphere of Attraction of them; and, on the contrary, it melts as soon as that Distance from Repulsion is greater than the Sphere of Attraction in the Particles of Sand; and as heterogeneous Bodies are carried off by the Fire, or at least rise up to the Top, so the Sand, thus prepared by the Fire and suffer'd to cool, sticks together in one Mass, as if it were one Grain of Sand, and this Solidity depends upon Attraction and Surfaces.

Sulphur

Sulphur attracts Silver and amalgamates with it and Mercury, so as to tarnish the first of a blackish yellow Colour, and so as to fix the other, even in the Blood, that it shan't raise a Salivation, if blended with it, and that it shall even stop one already raised, if it is given to two or three Drams at several times: hence *Æthiops Mineralis* is made with Sulphur and Quicksilver.

And if Antimony be clean'd with common Salt and Water, and then be dried and blended with Quicksilver into an *Æthiops Mineralis*, it is reputed an excellent antiscrophulous *Æthiops*.

And *Becher* affirms, that if to *Hepar Sulphuris*, or if to Sulphur whilst melting with fix'd Salt you add Gold, the Gold will be dissolv'd.

Hence is it, that Balsam of Sulphur will sooner dissolve and divide Mercury than Turpentine, for mixing it with Ointments.

Mercury also amalgamates with Gold, Lead, and Tin, but not with Iron or Copper, unless by some intermediate Body that joins with either alike; for we can turn Copper of a Silver Colour by mixing Mercury and Spirit of Nitre together, when the Quicksilver is dissolv'd, then we rub the Liquor on the Brads, and it turns it of a Silver Colour.

Deargentation of Copper, Instannation of Brass, and Deauration of Silver, are all of 'em Effects of Attraction, which, because they may be of Use to my Hearers, I shall briefly recite to them. *Copper is silver'd* in the following Manner: Take one Ounce of Leaf-Silver, and two Ounces of Salt, powder them together, then calcine them in a Crucible till the Salt is thoroughly decrepitated and the Crucible is heated: take two Parts of this calcin'd Powder, one Part of Cream of Tartar, or of crude Tartar, boil these in a suffi-

cient Quantity of Water ; then clean the Copper very nicely, by putting it in the Fire, and then by rubbing it with Sand ; throw it into the Water and let it boil for about half an Hour, and the Copper will be silver'd : and in order to make it bright, it is rubb'd first with Salt of Tartar, and lastly with Chalk. *Brass is tinn'd* in the following Manner : Take equal Parts of white and black Lead, melt them together, and with a Brush, or Cloth on a Stick, rub the Copper all over on the Inside whilst it is upon the hot Charcoal, first having rubb'd it over with Resin before you place it on the Charcoal Fire, and the Affair is done. *Silver or Copper are gilded* in the following Manner : Let the Vessels be polish'd and clean'd from all Dirt or Filth sticking to them, rub the Vessels moderately over with Aquafortis, and presently rub on the following Amalgam, and it will stick, to wit, reduce Gold to a Powder by filing, or take of Leaf-Gold one Part, four Parts of Quicksilver, put the Mercury into a Crucible, place it upon a Fire, and when it begins to smoak throw in your Gold in Powder or Leaf, stir them together with an Iron Rod, and then the Gold will be suck'd up by the Quicksilver, remove from the Fire, and let it cool, wash it with Water, rub this on the Copper or Silver, first cleaning the Vessel with Chalk. *Gilding with Antimony* is done thus : Take one Part of Antimony, two Parts of Salt-petre, one Part of Tartar, melt 'em together, pour 'em into cold Water, make a Lye of them, filter, evaporate, and you have a Powder ; put this Powder into Water and it will gild Silver ; but take care the Silver comes not near to Oil of Vitriol, for Reasons to be named hereafter. *Gilding or silvering Glasses* is done in the following Manner : There is made an Amalgam with Gold and Quicksilver, or with Quicksilver and

and Pewter or Tin, and this is rubb'd on, it sticks and gilds or silvers.

Myrrh, Benjamin, and other resinous Bodies are dissolv'd in the White of an Egg; to wit, let the Egg be boil'd to a Hardness, split the Egg, take out the Yolk, put the Resins in close, bind it up, put them in a Cellar, and expose them there for some Time, and the Resins will turn into an oleaginous Liquor.

Spirit of Wine dissolves Oils and Camphire, and rectified Spirit of Wine will dissolve Mercury Sublimate into an Essence.

Alkabest Glauberi dissolves Myrrh, Sulphur, and Elks-Hoof specifically.

Turpentine is the universal Menstruum of all hard ramosc BodieS, such as Copal, and even Camphire.

Whatever is dissolv'd by Vinegar is precipitated by Spirit of Vitriol; and, on the contrary,

Vinegar neither touches Bismuth nor Mercury.

Aqua-regia dissolves Gold, but not Silver; and Aqua-fortis dissolves Silver, but not Gold.

Tartar, and Sulphur dissolve Iron.

Oil of Aniseeds dissolves Coral by Digestion.

Spirit of Nitre acts upon Bismuth, and upon Butter of Antimony.

Aquafortis and Spirit of Nitre dissolve Sand, Stones, and even human Stones.

The following Things are dissolv'd in Water; Assa Foetida, Gum Ammoniack, Gum Arabick, Tragacanth, Dragons Blood, Starch, Sarcocoll, Manna, Honey, Cherry-tree Gum, Opopanax, Bdellium, Opium, Euphorbium, Gum Hædera, Camphire, Sagapenum, Balsam of Tolu, Myrrh; and Steel, if it be boil'd with Tartar; Sulphur if boil'd with Salt of Tartar, and Crabs Eyes if boil'd in distill'd Vinegar.

The following are dissolv'd in Spirit of Wine, namely, Opoponax, Sagapenum, Bdellium, Opium, Euphorbium, Gum Hædera, Camphire, Assa Fœtida, Galbanum, Olibanum, Mastick, Resin, Colophony, Gum Juniper, Pitch, Myrrh, Amber, Gum Lac, Wax, Turpentine boil'd, Gum Ammoniack, Balsam of Tolu, Benjamin, Caranna, Tacamahac, Storax Calamitæ, Gum Guaiacum, Resins of Jalap, and Scammony, Balsams.

The following are dissolv'd in Wine, to wit, Opoponax, Sagapenum, Bdellium, Opium, Euphorbium, Gum Hædera, Camphire, Assa Fœtida, Galbanum, Gum Ammoniac, Soot, or indeed every thing that can be dissolv'd either in Water or Spirit of Wine.

The following are dissolv'd in Vinegar, to wit, whatever can be dissolv'd in Wine, only the Vinegar weakens the Gums.

The following are dissolv'd in Oil, namely, Olibanum, Mastick, Resin, Colophony, Gum Juniper, Labdanum, Pitch; and Camphire is dissoluble in Oil of Almonds; Mastick is totally dissolv'd in Oil of Turpentine, Gum Copal is first dissolv'd in Turpentine, and then in Oil of any fort.

In the Sequel of these Lectures the Hearers will meet with many other *Attractions*, which I omit here, because they more properly belong to the Places where they are inserted; and altho' Experience, as I have already said, is the surest Guide to determine on Attractions, yet you will find some probable Conjectures upon them, as we advance deeper. In truth, this one *active Principle*, and its contrary, *viz. Repulsion*, are the last Refuge for all Reasoning, as far as I can see; for tho' it may be reasonably accounted for, why the Blood runs faster thro' its Vessels when it is thin, than when it is gross and thick, in the following

following Manner, namely, because it is then less cohesive, its Particles are then more spherical, they move about with greater Ease, the Salts of the Blood irritate the Vessels; yet why is it less cohesive, but because its Particles become spherical; and why are they of this Figure, but because the elastick *Aura* contain'd in the Globules expands itself around equally, when all Impediments are taken away; and the Impediments are a viscous cohesive Matter, which having a small Quantity of Matter with a large Surface, the Velocity will be lessen'd, as, *vice versa*, when the Circumstances are contrary, it will be greater?

The Force of *Attraction* is often greater than *Gravity*; hence comes it to pass, that warm Water will dissolve Cream of Tartar, which cold Water will not; because the Warmth dissociates the Cohesion of the Salt with its Earth, and then Gravity prevails, and the Earth subsides; and Quicksilver, which is much heavier than Balsam of Sulphur, yet is it suspended and dissolved in it much sooner than in Turpentine, because the Sulphur and Mercury attract each other; and thus may you mix Quicksilver readily in Ointments.

Is it not remarkable, that Scarlet cannot be done without a Tin Vessel? Or is it not strange, that Tin melted powders in a chalk'd Box?

Solution is an Effect of Attraction; and the greater is the Attraction, the greater is the Solution. Solution is a Division of a solid Body into small Raments: this Solution proceeds better in the Air, and by a moderate Warmth, as two impelling Causes; hence Flowers don't putrify if the Air is exhausted, nor does Vinegar work on Iron or Copper in the Air-Pump. In all Solutions there must also be a Congruity of Parts, so Oil of Tartar dissolves all Oils and Myrrh; aqueous

aqueous and saline Bodies are best dissolv'd in watry Menstrua ; Gums in Spirit of Wine ; and Metals in Acids : Antimony is better dissolv'd in Wine than Water ; Spirit of Wine dissolves oleous, resinous, and spirituous Bodies ; Cinnabar is dissolv'd in Oil.

All Menstrua are liquid, generally speaking, however, Myrrh and Camphire, as also Salt of Steel and Sugar of Lead are solid, till they are mix'd, and then they become soft and pappy, and the first make into Pills readily, and the latter is made into a Tincture with Spirit of Wine.

There is nothing of fix'd Salt, or very little, found in the Blood ; the Reason of this is, the greater Attraction between the Acids and fix'd Salts, than between them and the volatile Salts ; for there is enough of a marine or armoniacal Salt found in the Blood, but this marine Salt is only a fix'd Salt and an Acid join'd together ; so that this Assertion is rather an Effect of Ignorance, than a standing Truth.

Well may we grant that Power to Intelligences, which we experience in Attraction ; which suspends the Gravity of Bodies, because it is often greater than Gravity.

[R E P U L S I O N,

Is the contrary of Attraction ; it has also its proper Laws, known by Experiments ; for Repulsion begins, where Attraction ceases ; Bodies placed without their Sphere of Attraction are repell'd, and again attracted as soon as placed within that Sphere ; and those which are most attracted, are *vice versa*, most repell'd : This Repulsion is less between a hard and soft Body than between two hard ones ; thus Quicksilver unites

unites not with Iron, nor Oil with Water, Salt recedes from itself, and attracts the Water more, hence that Saltneſs in Water; Heat drives the Parts of fugitive or volatile Bodies beyond their Sphere of Attraction, which is small in itſelf. *Precipitations* are an Effect of Repulſion.

We may refer *Precipitations* hither.

I shall more particularly descend to mention the Attraction of Menſtrua: These are the main Instruments of Solutions, and we ought to be intimately acquainted with the Nature of them to be deem'd to have any Skill in Chymistry. I abstract from the *Chimæra* of trifling and deceitful Men, who have long boasted of an universal Menſtruum, an *Ignis Gehennæ*, or an *Alkabef*, by which they could diſſolve all Things, because Menſtruums muſt be ſometimes of a contrary Nature, and ſometimes of a like one to the Body to be diſſolv'd; for Example, Acids diſſolve and huff with Metals, and yet Water diſſolves watry Gums, and Spirit of Wine oleous ones: I wiſh any ſuch Inventor Joy of his Labour, and content myſelf with bare Possibilities. I ſhall take the Liberty to assert, that Experience alone has been our Guide in this Secret of Nature, ſhe alone has conducted us in this Point, and the more Experiments we try, the more are we daily inform'd upon this Head: In this Mr. Boyle has ſtruck out a very great Light to all his Followers, and there are few added ſince his Time to improve Mankind by; and as a great deal depends on this Head, I ſhall briefly collect from that great Author, and others, as well as my own Observations, what has been diſcover'd about them. Some of theſe *Menſtrua* are indeed more general than others, tho' none are univerſal: *Menſtrua* act by peculiar Properties in their Structure:

ture: The Pores, the Surface, the Cohesion and Attraction differ in all Bodies of different Natures; where the Attraction between the Body and *Menstruum* is great, the Body will be suspended in the *Menstruum*, and dissolv'd in it; so that there is no Suspension without a Solution, nor any Solution without Attraction, which is therefore the Basis of *Menstrua*: Who then is there that could ever have conjectur'd what Bodies would attract or repel each other, without having made Trials? Who could ever have known that Quicksilver would unite with Gold, Silver, and Lead, and yet not join with Iron, if proper Experiments had not been made? I say then, that we must rely upon Experience to inform us on this Point.

There are therefore various Orders of Dissolvents, of which I shall speak in this Chapter: First, *Menstrua* do often require some certain Conditions in order to put them in Force, namely, either Infusion in Water, Heat, Pulverisation, or exposing to the Air, of which in the Preparations. There are also *oleous Menstrua*, which dissolve oleous Bodies, for Example, Oil of Turpentine, common Oil, Oil of Juniper, and other Oils fix'd, essential or empyreumatical, do dissolve oleous and sulphureous Bodies; thus is made Balsam of Sulphur, which has various Names according to the Oils in which the Brimstone is dissolv'd, and as *Saccharum Saturni* is dissoluble in Oil, we conclude that there is some Oil in Sugar of Lead, and this more plainly appears in the Glass of it, which will deflagrate on the Fire; Antimony is also oleous, because it will afford a Balsam in Oil with Salt of Tartar: And as Oil of Aniseeds and Wax take the Colour out of red Coral, if thoroughly digested together, it is concluded by Lemery that the Colour of the Coral is from an Oil in it: Among oily *Menstrua* are reckon'd

reckon'd vinous ones, or spirituous Waters, these dissolving Amber, Castor, Saffron, Nutmegs, Cloves, Cinnamon, and all manner of spicey Drugs as well as Balsams of Peru, *Copaibæ*, *Micræ*, and such like, we justly conclude these Bodies to contain oily Particles in them, which communicate a Tincture to them; and these Tinctures do always argue an Oil in the Body communicating the Colour: If Metals then do communicate a Tincture to Spirit of Wine, they contain some sulphureous Particles in them; from which Axiom we may say, that Sublimate contains sulphureous Parts in it, because in making the *Essentia Mercurii Sublimati* or *Oleum Mercurii* the Sublimate is dissolv'd in the sulphureous Parts of the Spirit of Wine, or in its similar Parts, the Salts it is prepar'd with are sulphureous, and Mercury has some sulphureous Parts join'd with it; these are the Reasons given by some for the Tincture; but still the Salts swim in the Spirit also, and gently corrode; for as Spirits of Wine do dulcify acid Spirits, and the acid Spirits do suspend the Mercury, all three unite intimately together: And as Mercury in its own Nature is not cohesive, but upon the least Touch divides into very minute Globules, so it is not to be wonder'd at, that it will suffer as much Separation in the *Menstruum* as the Spirits of Nitre and Salt do, and consequently may swim by the Diminution of its Gravity, in any Liquor whatever, as well therefore in Spirits of Wine as in Water, in which Mercury sublimate dissolves.

Secondly, There are Spirituo-salino-alcalious *Menstrua*, such are Spirits of Salt Armoniac, of Hartshorn, of Ivory, of Horns of any Kind, and such a Spirit is obtainable from all Animals, and from Mustard-seed, Scurvygrafs, and all acrimonious Plants, in which the volatile Spirit ascends, that

that is, Water impregnated with volatile Salts, for volatile Spirits are nothing else, and generally speaking it is not to be distinguish'd, whether you put in any distill'd Water to a volatile Salt, or whether you use the volatile Spirit as it comes from the Shop, so an exact Proportion be made use of; for five Parts of distill'd Water and one of volatile Salt blended together are a volatile Spirit, and thus may a volatile Spirit be made out of the volatile Salt *extempore*, and if any one likes it of a brown Colour, you need only put a Drop of the Oil of Hartshorn to the Salt, and then throw the Water upon it, and this factitious Spirit will be brown; and as volatile Salts are not so apt to fly off in their dry Form as when dissolv'd in Water, it were no matter if the Spirit were always made *extempore*, nor are Patients at all deceived in the Effects of the Medicine: These volatile Spirits are a Menstruum, for they draw out a blue Tincture from Copper, and, as Mr. Boyle observes, would be useful to discover the Cheats of Gold Dust; because as it is usual with Negroes to mix Copper Filings among their Dust, and as Sailors are not skill'd in hydrostistical Trials, it is but pouring a little Spirit of Hartshorn or of any volatile Spirit into the Dust, and if it gives a blue Tincture to it, there is a Mixture of Filings of Copper in it, and it is therefore a Cheat: I don't know a better *Menstruum* for the Dissolution of Opium, than volatile Spirits, or at least than *Sal Volatile Oleosum*, which is a compound *Menstruum*, namely, it is *Oleo-spirituo-salino-alcalious*, and some Drops going under the Name of *Guttae Vitæ* may be this Preparation: By such a Remedy you do great Feats in hysterical Cases, where there is a small Quantity of animal Spirits that are always upon the Wing, for their Hurry is appeased by the Opium, and their Deficiency

is supply'd by the volatile Spirit, so that all troublesome Sensations, such are Pains and Irritations of any kind, are allay'd, whilst you give the Patients Life and Vigour; thus from a languid, despairing Condition you raise them to a lively State, which is heighten'd from a real Delivery from those spasmodick Pains, Vomitings, or Fluxes they were infested with before; thus is the *Essentia Tartari* a Menstruum for Paracelsus's *Elixir Volatile*.

Thirdly, Acid Spirits are a Menstruum for certain Bodies which they specifically dissolve: I speak principally of such as are highly pure and free from any other component Parts, that is, of such as *Aqua-fortis*, Spirit of Nitre, and the like; but as they are design'd for the Dissolutions of Metals, it must be observ'd, that Metals being of different Densities, they require the Spirits to be of a determinate Strength and Concentration; because if once we alter this Purity, we spoil the Menstruum; for Example, *Aqua-fortis* will dissolve Silver, but if we weaken it with Water, or make it too pure or strong, it will not then answer our Purpose; but when it is blended with Water, it will readily dissolve Lead, which it would hardly touch before, or when it is mix'd with common Salt, Salt Armoniac, or Salt Gemm, it will then be so concentrated as to dissolve Gold, for it then becomes an *Aqua Regia*; in short, these acid Spirits are the common Dissolvents of Metals and Stones, and from them thus dissolv'd and united with Spirits or Water, we meet with *Aurum Potabile's*, and many other boasted *Arctana*, which the Publick are gull'd and deceiv'd with, and which they should never touch; but Deceits of this kind are too easily swallow'd by the great as well as the small Vulgar; however,

they are readily discover'd by Precipitation and Fusion.

Fourthly, *Water* is a Menstruum for an infinite Number of Bodies, and particularly for such as are design'd for Diet; it is also a Menstruum for Salts of any Kind, and by the Mediation of those Salts it is also a Dissolvent of Oils: Hence is it, that Water takes a Tincture from bitter, and other oily Plants; for if there were no fix'd or volatile Salts in these Plants, the Water would draw no Tincture; because Oils and Water repel each other, as daily Experience informs us, but Oils united to these Salts intimately, do readily unite with the Water, and communicate a red Colour: thus it happens in the Juices of bitter Plants especially, for if they are exposed for some Time to the Air, they grow red, because the Oil and Salts in the Juice by the Moisture of the Air imbib'd, unite and become red, that is, they become a Tincture: But it must be observ'd, that I speak of pure Salts; for where Earth is in their Mixture, Water has not so ready a Force upon them; Water and Salts attract each other, but the same cannot be affirm'd of Water and Earth. There are some Salts more readily dissolv'd in warm, and others in cold Water; Cream of Tartar is hardly dissolv'd either in cold or hot Water, because it contains a good deal of Earth, which is strictly united with the Salt, which Salt attracts the Earth more strongly than it is attracted by the Water; yet by a small Quantity of Salt of Tartar, the Earth is dropt. Water is also a Menstruum for watry Gums, and for Mucilages; so Gum Arabick, Gum Tragacanth, Starch, and Jellies, &c. are dissolv'd in and extracted by Water. There is not a more universal Dissolvent therefore than *Water*, nor any one so universally agree-

agreeable to human Nature, and all other Animals; it has Qualities not to be parallel'd by any one Material, because it dilutes our Food, and helps greatly to extract the alimentary Tincture, which wou'd not pass into our Lacteals or our Juices, but go downwards, and prove useless: It keeps those Particles of the Blood at a Distance which being too near placed to each other would run into Clusters and stagnate in the smaller Vessels; it dissolves Salts, Mucilages, and mediately Oils also, and by reason of these Properties, Physicians have an Opportunity of conveying such Particles into the Blood, as they know by Indications are wanting there, and thus is it conducive to our Preservation, and the Cure of heavy and grievous Diseases also.

To this we refer the Solution of Salts, and all Oils *per Deliquium*; for it is certain, that the Reason why these Salts flow, is the Moisture, that is, the Water in Air; and altho' this Solution be done by the Force of the Humidity of the Air, yet there is an additional Body that privately insinuates itself, namely, an acid Salt that swims in the Moisture, for Salt of Tartar shews plain Proofs of this Acidity when it has run; thus Mercury Sublimate dissolves in Water, and it will also run in the Air, if exposed to it; all Salts of Plants, and all fix'd Salts whatever, will, when exposed, run; volatile Salts do also run, but then they become useless, but in Shops we have these Oils common, and they are more temperate than the fix'd Salts themselves, but are not so effectual for many Purposes, yet they are more grateful to the Patients when they may be used: If we put Salt of Tartar into a Bladder, and plunge the Bladder into warm Water, the Salt will run in an Instant, and this is an Oil of Tartar *per Deliquium* as good as any.

There are three mostly made use of in common Sale, namely, the Oil of Tartar, the Oil of Potash Salt, and the Oil of Alcahest *Glauberi*, or of Nitre calcined; there is certainly as much Difference in the Oils as in the Salts, which do plainly differ in Degrees, as *Tachenius* observes, by the different Colours given to the red Precipitate; so do these Oils differ in the Colours given to the same Precipitates, in the Colours given to Syrup of Violets, and to the Magisteries of Bones; all which distinguish their Degrees of Concentration, according to the Quantity of acid Spirit they imbibe from the Air, according to the Difference of their Figures and Pores, according to the Quantity of Salt in Proportion to their earthy Parts, which we shall never be able to find out but by Experience: Thus Oil of Arsenick *per Deliquium* is a strong Caustick, so is Oil of Copper.

Their Use is very extensive in Chymistry, because if Vegetables or Animals are moisten'd with them, you will thereby readily extract a Tincture from the oily Parts of the Body, because they attenuate Oils and mix with them, and because they dissolve in Water and mix with it, so that they are an intermediate Body between both, therefore they make Oils join better with Spirit of Wine, and make Oils even dissolve in Water, and consequently unite oily Parts to Wine or winy Liquors, which are but a Mixture of exalted Oil and Water; so that all Tinctures, that can be communicated to these three Liquors, may be made with them.

They serve also for precipitating Bodies out of Acids; so the Magistery of Tin is precipitated out of an acid Spirit by Oil of Tartar *per Deliquium*, so the Magistery of Coral is thrown out of Vinegar by Oil of Tartar *per Deliquium*; and the same may be said of them in most Magisteries.

Physicians make use of them internally in all Stagnations and Coagulations of the Blood, where the Work ought to be perform'd gradually, because they are properly neutral Salts in which the saline Parts are predominant; they therefore, from the Nature of a Salt, irritate and promote all Secretions, because they act upon the Fluids in making them thinner, and upon the Solids by increasing their Oscillations, and as the Secretions increase in Proportion as the Fluids grow thinner, and the Solids are made to vibrate, therefore do they prove diuretick, therefore are they good to open Obstructions of the Liver, and to re-promote the menstrual Flux, therefore are they very good in intermitting Fevers, because they attenuate and render the Blood equally fluid, and keep it from shifting.

Surgeons use them in external Cases, namely, in Ulcers, to mortify the Acid that abounds in them, and in Eruptions for the same Reason, and also to penetrate to the open Glands, and to close up their Mouths, and if to them we add any Oil and Sulphur, the Scab will be thrown off readily, and be cured.

Fifthly, Fix'd Salts are a very common Dissolvent, nor is there a more frequent one among the Chymists; no Tincture is drawn without these, because they are equally attracted by Oils and Waters, they cause the Oils of Materials to unite with Water, as has been observ'd, and they draw out the Oils better where the Menstruum is spirituous; for Oils are of different specifick Gravities, some swimming upon others; for Example, if you mix Spirit of Wine with Balsam of Peru, the Balsam sinks, and will not unite with the Spirit without a fix'd Salt and Digestion; the fix'd Salt destroys the Pitchiness of the Balsam; by destroying the Acid, that

made the Balsam thick, it becomes of equal Gravity with the Spirit of Wine, and then they unite together, and become a Polychrest Balsam, and may as well be call'd so, as the Tincture of *Gum Guaiacum*, for it may be justly used in the same Cases, saving that the *Guaiacum* is more Laxative, and if that Property is required, a small Quantity of Jalap will answer this End, and then there is no Difference; both will answer in internal or external Ulcers, both will answer in Cachexies, and Asthma's, and so of the rest.

Another Menstruum is a compound one, namely, made up of some Mixture of Bodies, such are all neutral Salts, such are Spirit of Wine tartarised, and the like; Salt, Salt Gem, or Salt Armoniac serve to absorb the Humidities of *Aqua-fortis*, and to render it a Menstruum for Gold: But there will be an Opportunity in these Papers further to illustrate *Menstrua*.

Lastly, There are some Menstrua which are thought such, namely, Metals or Minerals are Menstrua for some others; thus Lead and Antimony devour most Metals, Sulphur melts Iron; Iron melts like Wax upon applying it red-hot to a Magdaleon or Roll of Brimstone; if Iron be impalpably powder'd, (which is done by taking Iron red-hot and applying it, as is said, to the Roll of Brimstone, holding both over a Bason of Water, the Iron runs into a black *Crocus*, which is a Vitriol, and easily powders; or if we mix Coals with Brimstone, and place Iron upon this Fire with Grates under, and Water to receive it, we gain this *Crocus* very readily and plentifully, which is reducible to Iron) and Sulphur be mix'd with it, and with Water we make a Paste, a vast Heat arises, and at last a Flame; and thus may we account for the Heat of Baths (which usually contain Iron, as appears by Galls and Sulphur

by yellowing Silver) and Volcano's: But till Metals are made fluid, they can't properly be term'd *Menstrua*.

Hence, I say, Motion is consider'd in different Views; first, Motion may be consider'd in its Nature, or as it may be defined; that is, it may be consider'd in *Abstratto*, as in Power, or as we find it in Nature, that is, in *Concreto*. We know,

That every Body is moveable, and, *vice versa*, that what is moved is a Body.

That, however, a Body does not constitute Motion, nor does Motion constitute a Body.

That there are certain general Laws of Bodies moved, which are not deducible from the Properties that constitute Bodies.

That centrifugal Force, or a Conatus of proceeding on in a right Line, or of flying off in a Tangent from the Body whirl'd round, does not depend on Gravity, or any other Property constituting Bodies.

That some Bodies do more readily fly off than others, whether this depends on an Impulse from Fire, Air, or some inherent Impulse; thus volatile Salts do readily mount by Heat, or by being exposed to the Air, and Spirit of Nitre by a moving Property inherent in it.

That Motion can be destroy'd, contrary to *Cartesius*.

That it may be increas'd and diminish'd by adding or lessening Velocity.

That the same Motion has various Modes or Determinations; for a Ball struck against any Obstacle, goes forward till it meets with that Obstacle, and then it retreats: Now this Progress and Regress are the same Motion differently determin'd.

That nothing moves, but it depends on a moving Cause; as Philosophers say, *Quicquid movetur ab alio movetur.*

That Mobility differs from Motion, as Gravity differs from Gravitation, or the Powers from the Exercise of it.

That Velocity is an Affection of Matter distinct from it, because Weights remain upon Obstacles after the Impulse is destroy'd.

That all Heat depends on Motion; and Heat is the *Primum Mobile* of Distillations and Sublimations.

That Heat and Agitation do destroy Cohesion, and help Solution.

That Fire drives off all fugitive Parts easily, such as volatile Salts, Water, and Mercury.

That Heat rarefies and liquefies Bodies.

That Heat dissociates Bodies, and hence Water that is hot hinders Crystallisation, and lessens Attraction.

That Heat is caused by an intestine Motion raised between Contraries, which are in their Nature elastick, and are moved backwards and forwards, and therefore these Bodies have airy Parts in them.

That Heat, if moderate, unites Bodies; but if it be great, it dissolves them into Powder; and Reverberation, which increases Heat, makes all saline Parts fly off; for it evaporates all fugitive, and leaves nothing but solid earthy Parts behind.

That the Largeness of Surface helps Bodies to mount up by any given Impulse.

That intestine Motion makes Bodies more acrimonious; so Mustard and all acrimonious Plants by such a Motion become acrid.

That

That the lighter or less cohesive Bodies are, they mount the easier by any Impulse ; this is the Case in volatile Salts and Mercury ; and hence is it, that fermented and putrefied Bodies mount sooner.

That Acceleration is greater, where the Diameter is greater ; hence does any Traveller's Head make larger Journies than his Feet, by the whole Stature of the Itinerant ; as a large Wheel moves faster than a small one.

The Impulse given by Fire and Air is of an extensive Use in chymical Processes ; for if the Air is extracted no *Menstruum* will act ; its Weight is as a Pestle that presses Bodies ; it impels and gives Motion to different and heterogeneal Parts ; if Juices are cover'd from the Air, and the same is said as to Flesh or Butter, they neither ferment nor putrefy ; for its Pressure brings Parts together, and occasions their intestine Motion.

That the Fire in Lightning and in common Fire differ in Velocity, for common Fire melts whatever Lightning does ; but Lightning does in an Instant what common Fire does gradually : And if we consider the Cause of this, it seems to depend on the Velocity with which it is exploded. Heat increases with the Density of the heating Matter, and the Velocity of Motion, and the Concentration of the Rays of Heat ; it is also increased by Pressure, as by Bellows and Flews ; Fire convey'd in long Tubes burns the fiercer ; the Heat of Gold is greater than that of Iron, and heated Iron is four times hotter than boiling Water ; this Force does not depend on the Matter's Density, therefore either on its Concentration, Pressure, or Velocity separately or conjunctly.

All occult Qualities proceed from substantial Effluxes, or subtle Parts flying off by Motion ; but Motion is so various in its Modes, that we can't explain them all.

Elasticity, whose Physical Cause we know not, is an Effect of Motion ; but so much we know by Reason, that the Pores of the Body are enlarged one way, whilst they are contracted the other ; its Rules are known by Experiments ; we know it may be destroy'd or increas'd, and by what Means.

Duration is a Mode of Motion ; it is measured by Time, and Time is measured by Motion ; whatever continues therefore a longer Time, must argue a greater Degree of Motion impress'd on the Part moved ; wherefore if any Taste strikes the Organ more durably, it must act more forcibly ; hence as an acrid and bitter Taste lasts more durably upon the Tongue, than an acrid alone, it must act more forcibly than the latter ; hence is it that the Water-Trefoil is better in a Scurvy than Scurvygrafs : This we experience in the Heat of the Sun, where if the Verticity is small, and the Duration great, the same will be produced as if the Verticity were great, and the Duration small ; the Sun's Heat being in a Ratio compounded of its Verticity and Duration.

Motion is an Affection of Matter ; but Matter subsists without it, and it is evident, that there are general Laws of Bodies moved, which are not deducible from the Properties that constitute Bodies, for the centrifugal Forces don't depend on Gravity, but on an *Impulse* by which Bodies have a *Conatus* impress'd on them of going on in a right Line from the Center, or of flying off in a Tangent, if nothing hinders them.

The greater is the Quantity of Matter, the greater is the Impulse.

To Motion are reduced several Operations and Preparations in Chymistry, for they are all produced by an Impulse given to them from the Fire; I shall therefore descend to them, that you may be better enabled to reason on their Effects upon human Bodies, and to judge how these Effects are brought about; because without such a previous View, nothing of what is said in the Second Part can be thoroughly understood.

Wherefore I shall speak of them in Order.

First, There are many Kinds of Furnaces made use of by Chymists, but the following are most in Use, namely, a *Balneum Mariae*, or a *Sand Heat*: This Furnace is made as usually with Bricks, and between the Fire and Still there is an Iron Bottom, and Sand, upon which a Glass Still is placed to call off the Matter design'd, when only a small Heat is required to call off any Particles, or we would avoid burning, call'd by the Chymists *Empyreuma*, this Furnace is made use of: This Furnace does not only distill, but it serves mostly for Digestion, and for the Dulcification of acid Spirits, as also for many other Uses to be mentioned in the Sequel of this Discourse.

Another Furnace is the *Hot Still*, where the Furnace is built as before, but there is an Ash-Hole, and a Fire-place with a Chimney to it, and an Iron Pot placed over the Fire-place and clos'd or wall'd in; this Furnace serves for the Distillation of strong Waters, Empyreumatick Oils, and other Materials: I have mentioned that Iron should be made use of, because if any Acidity be in the ascending Particles, the Copper will become a Verdigrease: In this Furnace we often see a Pipe placed in Water, call'd the *Worm*, for cooling the Matter distill'd.

Another is a *Reverberatory Furnace*; this is done with an open Fire, the Furnace, as before,

has

has an Ash-hole, a Grate, a Fire-place with a Chimney, and upon this Fire is placed an Earthen or Iron Retort fill'd with Matter to be distill'd or sublim'd, then over all a Dome or Cover of Iron or Earth that will bear the Fire is placed, and by continuing the Fire the strongest volatile or acid Spirits are obtain'd; by this Fire we gain volatile Salts, Spirits of Hartshorn, of Bones, of Ivory, of Vipers, and the rest; by it we draw off the acid Spirits of Nitre, Oil of Vitriol, Aquafortis, and such like; but it is to be observ'd, that Iron Retorts are improper for drawing off acid Spirits.

Another is a *Flew*, for melting of Metals, and for Calcinations; there is indeed an open Fire without a *Flew* for bare Calcinations; however, as there are open Fires, as well as the Reverberatory, I shall refer my Readers to consult larger Volumes, or to step into a Chymist's Shop, where half an Hour will inform him of all these Differences with great Ease.

The *Vessels* made use of in Chymistry are either of Metal, Earth, Wood, or Glass; those of Metal are made into Alembicks, Stills, Retorts, &c. those of Glass are Retorts, Recipients, Bolt Heads, Stills, Bells, &c. and those made of Earth are Retorts, Cupels, Crucibles, &c. and in these different Materials the Things are digested, circulated, distilled, sublimed, crystallised, fermented, calcined, fused, coagulated, revivified, rectified, purified, cohobated, dissolved, and precipitated.

The Instruments of Chymistry are, the Air, Fire, and Menstruum; the noted Properties of which I shall briefly take Notice of. The Air is call'd the *Pestle* by some, because it helps to blend Bodies together, and to comminute them: it conduces to Fermentation, Decrepitation, and

other Operations ; no Menstruum acts without its Assistance ; its Weight, its Elasticity, and its easy Penetration into Bodies help forward all Preparations ; if it did not penetrate, and were not detain'd in the Pores of certain Bodies, they would lose all their Pertness, and taste flat, as appears in Liquors from which the Air is exhausted in the *Air-pump*, tho' before they were put in, they tasted lively and brisk, and nitted ; yet after the Air is drawn off, they taste pall'd and dead. To dissolve a Body the Access of it becomes necessary, it renders fix'd Salts volatile ones, by its Comminution of them : It contains a Moisture in it, which makes all fix'd Salts run, and turn into Oils *per Deliquium*, so fix'd Salt of Tartar by being exposed to the moist Air of a Cellar imbibes the Moisture there, and becomes Oil of Tartar by *Deliquium*, which a little changes the Texture of the Body, and consequently gives it new Virtues. In short, its Pressure makes distant Bodies approach, and if they have a contrary Disposition, a Struggle ensues, which leads to Fermentation or Putrefaction, and it helps the Fire to burn by its Admission, because containing Nitre, and the Coals Sulphur, these together burn.

The Fire is a violent Agent, its Form consists in a well temper'd Mixture of pure Oil and some Acid ; for it is observed that Oils and Acids burn stronger than Oil alone : Coals and Wood, its chief Pabulum, contain both these Principles plentifully in them. There is, however, a sensible Difference in these two Materials, with respect to other Effects produced by them : *London* is the most subject to produce Defluxions and Consumptions of any Air yet known, - and *Paris* scarcely at all ; the Reason seems to be placed in the Particles of the Coal, of which more elsewhere : Fire acts by its excessive Motion and Stroke on Bodies, and

and this Stroke is render'd more or less intense according to the Direction of the striking Particles: In general, Heat, as all other Qualities, is in Proportion to the Distance from the Fire; the nearer the more intense is it, and *vice versa*, the greater Distance any Body is removed from it, the more remiss is the Heat: However, it is observable, that Bodies placed at the same Distance are not always heated alike; for Example, in a Lamp-furnace the Fire will not heat near so much, or so quickly, if you suffer the whole Flame to touch the Vessel to be heated, as if the Flame touch'd in one Point only; the Reason of which is, that the Point is a *Focus* where the whole Force is collected; and a great Force levell'd against a Point is greater than half the Force dispersed against many Points; and common Experience shews us, that to seal Glasses hermetically the Candle touches the Glass at the Extremity of the Flame only, nor will the Glass melt otherwise; as we see daily practised by Glass-blowers.

Chymists regulate the Degrees of their Fire according to what they aim at; so for Smelting, Calcining, Vitrification, there must be the highest Heat that can be contrived; next to this is the subliming Fire; the third is equal to the Heat of boiling Water, and the lowest is equal to the Heat of our Bodies; all these different Degrees may be intended or abated at Pleasure; and it is all one how we apply these Degrees, so they be made use of; for a Burning-Glass will make the *Pulvis Tonitruans* explode, as well as Fire apply'd under it, so there be a certain Heat communicated to the Powder; and if to bring Mercury to a red Precipitate *per se*, there be required a slow Degree of Heat, it matters not whether this Heat be communicated by the Sun or the Fire;

Fire; and as we are certain that the Heat of the Sun will vitrify Silver and Gold also, which common Fires never could hitherto effect, it would be highly worth our while to inquire whether the Heat of common Fires may not be augmented to the same Degree? There is no Doubt but we have several *Data* to help us out in this Affair, and a late chymical Performance (tho' surreptitious) has given us some Hints towards it, which may be highly improved by observing some few obvious Properties of Motion: I shall only say, that Heat augments with the Proportion of Matter, so that Iron on Fire is about four times hotter than boiling Water, and so in Proportion are other Metals hotter than Iron, if they are specifically heavier: In the next place, it is possible to intend the Velocity of the Fire; if then any thing be committed to a Fire six times more intense, and six times more swift, it follows that this Fire will act *six and thirty times more violently than the former*. I have given this small Hint, altho' I have, for certain Reasons, forbore to proceed further upon it, designing to complete my Trials ere I publish any more Hints concerning this Topick: Do we not see the Force of Papin's Digester in turning Bones into Jelly? What may not be done with Fire made much more intense than now it is?

Lixivial Salts are certain Dissolvents of oleous Bodies, as Poleman found out; so that a Lixivium of Salt of Tartar dissolves Sulphur into Atoms (and unites with Oils into a Soap by Coction); *all alcalious Drugs then do attenuate Oils*, which Truth does not only appear in redistilling chymical Oils, which do by blending lixivial Salts with them ascend clearer and thinner, but if a lixivial Salt be put into Cream ready to be churn'd, the Housewife will never be able to

get Butter, till she throws in as much Vinegar or some acid Spirit as will overcome this lixivial Salt.

It may, in short, be affirm'd, that the acid Salts equally attracting Spirit of Wine and Mercury, the Spirit suspends the Acid, and this the Mercury.

Of DISTILLATION, RECTIFICATION, and SUBLIMATION.

Distillation is a calling off of the minuter Parts from Bodies, by which there is a Separation made of the more subtle from the more gross Parts: If there were no Agent to cause this Separation, the Body would be at Rest, and nothing would exhale and be call'd off; but Fire, or Heat, or Pressure, or Motion, being various Degrees of one and the same Thing, do put the Parts into a Hurry, and the thinner mount up and are distill'd.

If we had proper Materials we should see a Dew ascend from the Earth upon a warm Day; What other is that Moisture within our Garden Glasses after a Sunshine? What is the ordinary Dew falling at Nights, but the Steams that are elevated by the Heat of the Sun in the Day-time, and congeal'd by Cold, and so by acquiring a greater Gravity fall upon the Ground again? And this is truly a Distillation. Again, if two Bodies of contrary Properties meet or are blended together, a Struggle and a great Heat will ensue, and a Smoak will arise, which if taken into a Recipient will condense into a watry Substance; this also is a Distillation from the aforesaid Agent, Heat; and in this Manner we sometimes can gain from a Sand-Heat, what otherwise could not be obtain'd but by a Fire of the last Degree; let Oil

Oil of Vitriol and common Salt be put for an Example, the Salt may either be mix'd with the Oil of Vitriol alone, or the Salt may be put into Water, and then the Oil of Vitriol may be thrown upon it; as soon as the Mixtures are made, a Heat ensues, as also a Smoak; join the Retort and Recipient together, put them upon a Sand-Heat, and let them distil, and thus you will obtain a true Spirit of Salt by a very gentle Heat, which cannot be otherwise obtain'd but by a strong Fire and earthy Powders also join'd to it; and to prove that it is the Spirit of Salt that ascends, it will effervesce with Oil of Vitriol or Spirit of Nitre, and will give a yellow Tincture to Steel; and if the Salt at Bottom be Salino-vitrioline, then is that a Proof that the Oil of Vitriol remains join'd to the fix'd Salt, and the Earth of the common Salt, making thereby a saline and vitriolic Substance, such as happens to testaceous Powders blended with any acid Spirit: from whence appears the Usefulness of the Knowledge of proper *Menstrua*.

There are various Degrees of Fire to effect a Separation of Parts, computable by the Matter and Velocity, and in the common Way: There are various Sorts of Distillations, namely, there is a Distillation by Ascent, and another by Descent: The Distillation by Ascent is *direct* or *oblique*; where the Steams do readily arise, and in a plentiful Manner, we use the direct Distillation; and this we generally make use of where Bodies have been first fermented: Fermentation opens any Body, and renders it more elastick and less dense, that is, it renders Bodies lighter, so that the same Quantity of Matter appears under a larger Surface; from whence it is evident, that the elastick Particles are lodged in Cases all over the Body, which Cases breaking upon a

small Heat, the elasstick Particles mount into the Alembick plentifully, and are, when congeal'd in the Recipient, vinous Spirits: Where Bodies are specifically heavier, and do hardly yield to the Fire, we make use of the *oblique Distillation*; for as such Bodies are fix'd, and their Steams are not plentiful, they require a strong Fire; and their Steams being heavy, if the Vessel were to have a high Neck, they would return and circulate for ever, so that we should never obtain them; hence have Chymists made their Vessels awry, and have curved them; tho' this Circumstance is not necessary, because if the Vessel were direct, so it be low, it would answer our End as well.

There is also a Distillation by Descent; when Bodies are highly fix'd, this Manner of Distillation comes in Play; so Spirit of Salt is obtain'd by a Bell, so Resin is made, as also Pitch. The common Method of distilling by Descent is described in the following Manner; you take two Pots, fill the upper Pot, which is perforated at the Bottom, with what you would distil, lute on a Head to it, and lute the Bottom also of this bor'd Pot to the Mouth of the whole one; set Fire round, and the Matter will fall into the Bottom Pot; but as for getting the Oil of Salts, Chymists make use of a Bell.

Having said thus much of Distillation, I shall add a few cautionary Remarks, and then proceed to the Preparations obtain'd by it.

First, It is in our Power to augment or lessen the Fire at our Pleasure, and as no greater Fire should be made use of than is needful, it is necessary to be vers'd in the Nature of the Bodies to be distill'd: So have I known volatile Spirits distill'd without Fire; for as soon as you put Lime and Water to Salt Armoniac, there arises a Heat,

Heat, and the Lime fixes upon the loofen'd Acid of the Salt Armoniac, which leaves the volatile Salt d'luted with Water to fly up ; for lighter, as also spherical Bodies, mount more readily, because they cohere less.

Secondly, Acid Spirits require a very strong Fire, according to their Gravity, and as Oil of Vitriol is the heaviest of them all, it therefore requires the most lasting and violent Fire ; and here it must be observ'd, that the Neck of the Vessel must be low, according to the Gravity of the Spirit ; and as the Ascent is proportionable to the Weight, those Bodies which require the strongest Impulse, are the strongest.

Thirdly, If we would obtain any acid Spirit from Gums, we must attenuate the Oils by some alcalious Matter ; so if we would obtain the Acid from Gum Elemi, we mix any testaceous Powder.

Fourthly, Sulphureous Bodies mount more readily, if you inlarge their Surfaces, and add a little Heat to them : This we see our common Housewives are appriz'd of for getting their Cream, they put their Milk in Vessels with broad Bottoms, and keep it warm, by which Artifice they catch their Cream plentifully and quickly ; so in distilling Oils, the Stills ought to have broad Bottoms, and then a gentle Fire will make them mount readily.

Fifthly, If the Matter will afford much Matter, the Clouds arise in great Quantities.

Sixthly, There should be a Proportion between the Vessels and the Fire, because great Fires require strong Vessels, and *vice versa*.

Seventhly, The nearer the Fire is to the Matter to be distill'd, the more intense is the Heat ; for all Qualities are intended in a duplicate Ratio of their Proximity to the radiating Point ; that is, if one Body be doubly nearer the Fire than an-

other, it will be four times hotter, or at a double Distance, then it will be four times less hot.

Eighthly, Every Body that affords a Steam may be distill'd.

Ninthly, Such Things as will run or fuse, are hard to be distill'd; hence Salt-petre cannot be distill'd till we mix some intermediate Powder to hinder its running.

Tenthly, *In Vegetables and Urinous Spirits*, first the Spirits ascend, and next the Water; but *in Acid Spirits*, the Water first ascends, and then the Spirit: The Reason of which is evident; for the Order of Nature is, that the most light Parts do mount first, unless there be some Impediment; thus in distilling Hartshorn, the Bones surround the Spirits, and the Water is disintangled; so that the Water in this case mounts first, and the Spirits last; the volatile Salt is more attracted to the Horn than the Water: This appears in putting Spirit of Hartshorn to burnt Hartshorn powder'd; for it adheres so strongly to the Powder, that it loses its Smell.

Eleventhly, Oils are late in rising up, and are therefore not readily distill'd, because, though the highest mount first, yet Cohesion is often a stronger Cause than Levity; Oils are, indeed, lighter Bodies than Water, but then they cohere more strongly, and the Fire must move all together, or none.

Twelfthly, There is an immediate Distillation, and to such Bodies as we design to destroy their Connexion, ought this Method to be made use of; and there is also a mediate Distillation, when Sand or Filings of any Metal intervene between the Fire and the Matter to be distill'd: And this Distillation is used in volatile Drugs; nor do such Drugs by this means ever contract an Empyreuma, and therefore the real and natural Smell of volatile Spirits

Spirits is not communicated from the Fire, but from the Nature of the Drug itself, and there are other collateral Proofs of this Assertion, which lay claim to be mention'd, namely, If Fire were the Cause of the Smell of Salt Armoniac, and not the *Menstruum*, it would follow, that a hot Iron apply'd to crude Salt Armoniac, would call off its Spirit, but this is not Fact; for a hot Poker does not free the Spirit, which a little Quick-lime effects immediately, if rubb'd upon it. Quick-lime absorbs the watry Parts, and licks up the acid in Bodies; if volatile Spirit become free of these two Parts, they become strongly concentrated and caustick.

Thirteenthly, In volatile Spirits obtainable from Vegetables or Animals, if the Bodies from whence they are drawn be hard, as in Horns and Bones, Chymists make use of an open Fire, but if they are soft, as in Soot, Blood, Urine, or Salt Armoniac, they use a *Sand-Heat*; and it is to be observed, that volatile Spirits, which are not drawn off but by an open Fire, are always Empyreumatical, and consequently nauseous; they have, indeed, a compound Smell, namely, they smell of burning besides their natural Smell; as to their natural Smell, some deny them to be naturally in Bodies, and sustain, that all volatile Spirits are Creatures of the Fire: They are, indeed, Creatures of Motion and Digestion, for they are found in Cheese, in Horns, and in Vegetables without the help of Fire; if, for Example, we design to make a Glue for joining broken China Dishes, by mixing Cheese, Quick-lime, and a little Water together in a Mortar, we presently perceive the volatile Smell to twitch our Nostrils; or if we rub Horns in the same manner with Lime, the Scent strikes our Nostrils; so that a middle Way is to be sustained between those who affirm volatile Spirits to be absolute Creatures of the Fire, and others,

who would have them to be simple and uncompounded or principial Bodies; for they are found to contain some earthy Parts, some oily, and some acid Particles, and a bare Digestion gives them a Being in Bodies: Nay, they are obtainable from Jellies without a preceding Putrefaction.

Fifteenthly, Volatile Spirits are much lighter than our lower Air, nay, even than the Æther itself, because their Steams or Effluvia, which lodge in the Water, fly up strongly and incessantly till they leave the Water mere Element; they therefore are most subtle Bodies, and endued with great Motion and Velocity, and are therefore fit to penetrate into the most minute Recesses of all Bodies.

Sixteenthly, The particular Method of preparing Empyrenmatick Oils, as well as acid Spirits, from Vegetables is perform'd in the following manner; we take a Vegetable and cut it into small Pieces, we put it into a Retort of Earth, and evaporate the watry Parts by a gentle Fire; when it smoaks no more, then we join the Recipient to the Retort, and lute them together, we gradually augment the Fire, and distil till nothing more comes off; then we let all cool, and separate the Oil from the acid Spirit by a filtering Paper.

Seventeenthly, The Method taken to gain volatile Spirits from Vegetables, is this, we take, for Example, of Soot join'd to four or five Parts of Sand, as much as will fill a Retort of Earth powder'd, and mix a little Water with them, and put it upon an open Fire, augmenting the Fire gradually, till we bring it to the last Degree of Heat, and then come off the Spirit and Oil in a plentiful manner. After the same f-shion may we obtain a volatile Salt of Tartar; for Example, we take the Dregs that are left after the Distillation of Spirit of Wine, and suffer them to be expos'd till they have a noisome Smell,

Smell, then we put them into a Retort, and distil in an open Fire, and we obtain a volatile Spirit, a volatile Salt, and an Empyreumatick Oil: This volatile Spirit is got in a plentiful manner, and the Oil is as good as any other Oil for use. This Process is seen in the *Collectanea Chymica*, p. 437. in the following manner; Take the Lees of Wine, as much as you please, expose them to the Air in a dry Place, where there may be no Danger of Rain; in process of Time the Lees will be cover'd with a woolly Surface; when this Wool appears, put them into an Alembick, and distil, and you will obtain a volatile Salt, agreeing in Suppressions of Water, and nephritick Pains, in the Gout, and in Obstructions of the Menstrua and Nerves. It is somewhat surprizing, to say no more, to find a late Professor under an Amazement, that none have allowed that volatile Spirits could be procur'd from Plants, save himself; but he vouches near half a Century too late, many having publish'd their Sentiments on this Head before.

Eighteenthly, Volatile Spirits then are obtainable from all Sorts of Animals, even from Insects; so from Flesh, Blood, Urine, Bones, Teeth, Ivory, Hoofs, Hair, Bristles, Silk-Worms, Buggs, Millipedes, Vipers, Eels, Stockfish, and all Fish, as also from Scurvygrafs, Brooklime, Cresses, and all acrimonious Plants, and all Plants putrified, they are to be had, nor do we look upon one more eligible than another, than as they are higher digested in one than another: Those the most exalted contain the least Acidity in their Composition, and this is discoverable by an easy Trial; What is the Reason that Spirit of human Blood is so cried up by Mr. Boyle before Spirit of Salt Armoniac? but because it is purer, that is, it is more exempted from any Acidity than it; for rectified Spirit of human Blood turns Copper a clear Blue, whereas Spirit of

Salt Armoniac turns it a palish greenish Blue : Now the more exempt a volatile Spirit is from any Mixture, the more powerful Alcaline is it.

Volatile Spirits are got from Bodies so long as there is any Humidity in them, when that is exhausted, then mount the volatile Salts. Where any Body that is to be distill'd is apt to fwell, we ought to mix Sand, Flints powder'd, or any other Matter that will hinder it : The Reason of which see in the *Second Part* under *Earths hindering Expansions*.

All volatile Spirits precipitate Mercury sublimate into a white Precipitate out of Water.

The Effects of these volatile Spirits are extensive and manifold, to wit, they excel in Apoplectick and Epileptick Cases, in all Obstructions of Women, and others, in Malignant Fevers, in Hypochondriac Cases, in Palsies, in Contusions internal, and where-ever the Blood wants Motion and Coagulations are generative.

Nineteenthly, Spirit of Wine is neither an Oil nor an Acid intirely ; for were it an Oil, it could not make a *Tartarus Vitriolatus*, when Salt of Tartar is mix'd with it, and it is either distill'd or decanted off from it, as it does ; because, whether we put Salt of Tartar into Spirit of Wine, and shake them often together, the Spirit will be rectified as well as if we had used the Fire for that End, and by decanting off the Spirit from the Salt of Tartar, we find the Salt has become vitriolated at Bottom as well as it does upon Distilling ; and were it all acid, it would not flame up as it so readily does ; wherefore those Authors are under a great Error, who determine it to be an acid Salt. It is a Mixture therefore of both, but is mostly a rarefied Oil, and this appears more evidently from an *Apparatus* made use of by

Chymists,

Chymists, by which they can bring Spirit of Wine to an Oil: This Spirit of Wine, and indeed all ardent Spirits are call'd *Mercury*, or one of their Principles; not that it really is such, for Compounds are not Principles, but in that they were not quite so curious as the present Age is.

Twentiethly, The Method of preparing Brandy Spirits is by a preceding Fermentation; for Example, if you design to make Malt Spirits, you take Malt, you bruise it or grind it small, you pour on boiling Water, and let it stand for some time till it has extracted the Tincture of the Malt, and if you dissolve some Salt of Tartar in the Water pour'd on, you will get out all the Tincture in a short Space of Time, then you let off this Tincture into a Vessel, and boil it till it becomes of a Consistence near that of a Syrup along with Hops; to this Liquor you put Barm, and stir them together from time to time, till it ceases to work: This Liquor thus fermented, is put into a Still of Iron, and the Brandy Spirit comes over the Helm: Wine fermented gives the best Spirit; but all Vegetables whatever, as Apples, Pears, Honey, Sugar, Manna, and even Plants of any Kind, will afford Brandy, if manag'd after this manner; however Wine and Malt are most commonly made use of; and in *England* they are come to great Perfection in making Malt Spirits: The great Difficulty is in taking off the Smell that Malt Spirits have; some make use of the Spirit of Nitre mix'd with the Ale before you distil them, others cause a Salt made of Pot-Ashes, or of Nitre and Tartar calcin'd together to be put into the Still, others again make use of calcin'd Chalk, or indeed of any Earth calcin'd, because the Acid joins in with the Oil, that gives the rancid Smell, and detains it at Bottom, and the fix'd Salts as well as the Earth

Earth attract the same Oil, and make the Spirit inodorous and sweet, and if this Spirit be kept cool, and for a long time together, it mellows exceedingly, so as to be hard to distinguish it from *French Brandy*, particularly if we mix a little of the Dregs of Wine along with the Ale which we design to distil. Of late, some who had the Art of making *English Spirits* very good, were not contented with the Secret, but they aim'd at vending their *English Spirits* for *French Brandy*, and at receiving double Prices for *English Spirits*: The Method they took to compass their Design was, by advertising an *Effay-Liquor*, which they pretended would distinguish *French Brandy* from Rum, Arrack, and Spirits; they, forsooth, order'd a few Drops to be dropt into the Liquor you were to try, and if it did not turn of a purple Colour, it was not right *French Brandy*: But lo! the Art of these Chicaneurs, no Brandy, altho' truly *French*, was to pass muster unless it turn'd Purple, and as none would answer the Trial but such as they had made, therefore all Brandy, except their own, was to be rejected. In order to prove this a wicked Collusion, a Gentleman of my Acquaintance, from whom I have received Authority to communicate it to the World, set about to discover the Deceit, he suspecting by the Tafte and Effervescence with Chalk, and the brown Colour it left upon the Chalk, that the Liquor was *Steel dissolv'd in an acid Spirit*; and in order to find whether his Conjectures were true, he dropt some few Drops of this pretended *Effay-Liquor* into *Green Tea*, which it immediately turn'd black as Ink; he again clear'd the Tea with Lemon Juice, and then made it black again with a volatile Spirit: In the next Place, he took some Galls and scrap'd it into common Spirits, Rum, and Arrack, and

and then dropt the *Essay-Liquor* into them separately, and they did all turn as purple as the pretended *French Brandy*; from whence it was evident, that no Brandy, which was not of their Manufactory, would answer the Trial, and consequently; had the Cheat prevailed, all Brandy, though most excellent, would have been rejected save their own; so that we should have paid excessive Prices for *English Spirits*, and none could answer this Trial save the Colluders; however, it was timely prevented by the Person who gave me the Liberty of publishing the intended Cheat. We find by Example, that *Oils* that smell ill, become fine fragrant Liquor if we mix them with any fix'd Salt and toss them in a Mortar, and then distil them; from whence it appears, that the Scent depends on a certain and too great a Proportion of Oil, if this be too plentiful, they smell rank and offensive, if part be taken away by any of the Means prescrib'd, they become fragrant, nay, the very exposing Spirits a little to the Air will take off this noisome Smell, and *Rum*, which is Brandy made of Sugar Canes fermented, may be robb'd of its odious Smell, if you burn it a little: From all which it may be inferr'd, that we need only carry a little of the abundant Oil away, by Evaporation, Absorption, or Dilution, and this stinking Smell vanishes. But moreover, there is a certain Union of Acid join'd along with this Oil, that helps forward the Rancidity; for it is very plain, there is such an Acidity in Spirit of Wine, and other Brandy Spirits, though highly rectified, because put a little Salt of Tartar to such Spirits, and evaporate all the Liquor, you find Crystals, which are the Salt of Tartar join'd to the Acid of the Spirit, making a *Tartarus Vitriolatus*; hence the Rancor or fetid Smell is made also by

by the Acid, which taken away, the Spirit loses that ill Smell.

21. With Spirits of Wine we prepare many Essences and Tinctures, whether from Vegetables, Minerals, or Animals ; so Tinctures of Cantharides, of Castor, of Saffron, of Antimony, of Steel, of Silver, and the rest : From the Vegetable and Animal Kingdom these Tinctures are mostly Sulphureo-Saline ; but as to the Minerals, it is fear'd little of the Sulphur is communicated ; and as to Steel and Antimony, there is no doubt but they contain a good deal of sulphureous Parts ; but Gold and Silver seem too hard to contain any, and therefore the Tincture they give out is Particles of Metals themselves divided into small Raments, and made to swim in the Liquor ; the Spirit of Wine being no Precipitant, and being lighter than the *Menstruum* they are dissolv'd in, the small Particles of Metal are kept suspended, because the Spirit of Wine unites with the *Menstruum* : There are Tinctures made proper for most Diseases that can be nam'd ; for Example, there are Tinctures levell'd against Disorders of the Head, such are those made of Castor and Amber, these add active Parts to the Blood, and remove Obstructions, which cause infinite Diseases and Symptoms ; Tinctures against Diseases of the Stomach, which do frequently arise from Crudities heap'd up there, such are the Tinctures of Zedoary, of Cassamunair, of Pepper, and the like, these by their volatile oily Parts exalt the vapid Mass in the Cavity of the Stomach, and give it a proper Pertness ; they also secondarily give the Coats of the Stomach a fresh Elasticity, and then the Digestion will for the future be better executed ; and so of other Tinctures too tedious to be mentioned in this Place. So that Spirits of Wine are the most common *Menstruum* in Use in Chymistry

Chymistry for most Things in Life, particularly where it is pure and freed from its grosser Parts, which is done in the manner aforesaid, that is, by Rectification in various manners; not only do Physicians order Tinctures, but also Cordial Waters from Spirit of Wine, which have their Efficacy according to the Ingredients blended with them, so that some are Anti-asthmatick, others Carminative, others Bezoardick, others again Cordial, and the like: Hence Spirits of Castor and Saffron are esteem'd Cordial; and, in Fact, we find them to obtain in Practice with desir'd Success, but then there is one Caution to be observed, which they who use them are little aware of, and it is this, that these Cordial Waters when they are taken alone in any Quantity, have the ill Effect of hardening the Blood, and of coagulating it into Clusters, as has been experienc'd in opening those poor Creatures who have destroy'd themselves by common Spirits, for they are generally found to have polypous Concretions lodging near the Heart, which put an intire Stop to the Circulation, and cut off their Thread of Life.

There is one Thing observable in Compound Waters from Aromaticks, that they are always white or whitish according to their Strength, because the oily and resinous Particles are blended among the watry Parts; however, such Waters by Age grow clearer, or if we have no Patience, we put in a little Oil of Vitriol, or any acid Spirit, or a small Quantity of Alum, and by any one of these the Spirit grows clear, because these acid Ingredients make the oily Parts grow heavy and pitchy, and then they subside to the Bottom, but to what Purpose? for we rob the Water of great Part, if not of all its Efficacy; the only true Method of making these Waters clear, and yet to retain

retain their Virtue intire, is to cohobate them often, then these resinous Oils grow thin, and they unite throughly, and the Water is then clear ; that is, if we would have them clear and yet effectual, we must take the Pains to rectify them, and distil them over and over the Helm again, by which Method Butters of Wax or Antimony will grow limpid ; and in the present we succeed the better, if you rectify with any fix'd Salt, or with Quick-lime.

22. As for acid Spirits, they are Salts more or less diluted with Water, and are really Salts when we rob them of this Humidity ; for keeping Oil of Vitriol some time in a warm Sand-heat, it will at last turn Solid if you put it into any cool Place, and the more pure they are, the sooner may this be done, but then it runs again at the Approach of the Fire. The purer these Spirits are, the more specifick Gravity have they according to the Salts that they contain ; but of all these, Oil of Vitriol is the heaviest ; and those which are heaviest are generally the most quick in their Operation ; for these Salts are sharp-pointed and sharp-edged, so that as they excel in these two manifest Properties, Dagger-like, they stab and cut ; now as they are thus circumstanc'd, they want nothing but an Agent to force them into the Skin to make them corrode it ; this Agent is found in the Moisture and Heat of the Skin, both which dissolve these Salts, which makes Salts to act : Besides this Dissolution, which is a Condition without which Salts never act, acid Salts are indued with an intrinsick Principle of Motion, being very attractive, and as the Steams of a human Body are volatile oily Spirits, as can upon many Experiments be made to appear, these contrary Salts struggle together, and by such a Motion the Fibres are corroded.

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These acid Spirits are distill'd in a Reverberatory Furnace in an Earthen Retort, because any Metallick one would be in Danger of being corroded by them ; and as their Steams rush out plentifully, the Recipient must be very large, for fear they should crack it: They are obtain'd from a great many Vegetables, but mostly from Minerals ; for Example, Sugar if it be distill'd, affords an acid Spirit that makes *Saccharum Saturni* ; in like manner Brandy distill'd gives out a gentle acid Spirit that effervesces with Coral, or any other testaceous Powder ; Honey gives a fourth Part of Spirit that is Acid, and will do any Feat that a weak Acid will do ; Raisins afford an acid Spirit, and that is the Reason why Verdigrease distill'd gives out an acid Spirit, for the Acid in the Raisins fixes upon the Copper, and turns it into a green Salt, as it is common with Brass Locks, which upon any Acidity whatever do turn green ; so *Saccharum Saturni* distill'd, returns its acid Spirit the Lead had imbib'd before, and this is properly nothing besides the Spirit of Vinegar, which lay conceal'd in the Sugar : All Metals become Vitriols upon affusing Dissolvents, which are always Acid, with this Difference, that some require the most concentrated Acids, whilst others require the weakest Sort ; so Gold requires *Aqua Regia*, or a very much concentrated *Aquafortis* : And Lead is dissolvable by the weakest that can be found. But still if we want to recover the Acid and to leave the Metal behind, we effect both by Distillation, because the Acid mounts up, and leaves the Metal at Bottom, which may be made to run with proper Flux-powders, and even sometimes by the Help of the Sun alone. Some acid Spirits may be gain'd without Additions, but Salts that run, or that lie close together, must have some earthy Body to inter-vene :

vene: This is the Case of Nitre and common Salt; and as Alum and Vitriol have Earth enough in their Composition, therefore we add none to obtain their acid Spirits; whereas to Salt and Nitre we are obliged to add Bole, Brick-Dust, or some such earthy Body in a good Quantity, because as the Spirits are only forc'd from the Surfaces of the Salts, Salt-petre by running together, or flowing, makes one continued Surface; and Salt by its lying very close makes one contiguous Surface, so that the Fire does not penetrate it; and hence it is that Salt keeps Eggs in a Chest without smelling, because the Heat of the Sun cannot penetrate it: Now as the Surfaces of Salts in Powder are greater than in one continued Mass, we therefore get more of their Spirits when the Fire reaches each little Surface, which it does by interposing an Earth, particularly such an one as will turn into Fire by Calcination, for then there is an actual Fire applied to each Surface, though ever so minute.

These acid Spirits are gain'd highly concentrated if they are distill'd from any metallick Crystals; for as the purest Parts of Acids join in with Metals, if once you have got the Crystals, you distil them and regain this concentrated Spirit that was join'd to them: So from Verdigrease distill'd we gain the strongest Spirit of Vinegar; from Crystals of Silver we get the most concentrated Spirit of Nitre, and so of all others.

Acid Spirits should not be distill'd in Copper Vessels, because they become Verdigrease; for the Spirit preys upon the Metal, and carries some of the metallick Raments along with it, which may be seen in pouring on any alcaline Body to the Spirit, and the Copper falls to the Bottom; but moreover, such acid Spirits given internally will

will vomit the Patients that take them, because they are impregnated with Copper; however, if we use a Copper Alembick of any Height, and a Glass Recipient, we obtain the acid Spirit freed of the Copper, for it will not mount so high: This puts me in mind of the *Grotta di Cane*, where the metallick Parts, which kill the Dog, or extinguish a Candle, do not mount high, for the Dog must be held low with his Head before you can suffocate him, and so must the Candle to be extinguish'd, and the Earth is colour'd green only for a little way up in the Cave; neither is the acid Spirit colour'd green unless the Still be very low, for then it has a green Tincture like Copper infused in Acids, and kills Worms, vomits and purges: Hence assoon as a certain Degree of Impulse ceases, the heavy Parts, which only mounted up by such Force, fall down again by their Gravity.

Some of these Spirits are more readily distill'd than others, so Aqua Fortis requires a less strong Fire than Spirit of Nitre, because Salt-petre and Vitriol struggle with each other, and make in Distillation an additional Fire, which cannot be said of Nitre distill'd alone; Do we not see upon the same Score how readily Spirit of Salt is gain'd by, nay even without, a Sand Heat, if you pour Oil of Vitriol upon common Salt? These three Salts do loosen each other, the Reason of which is not so plain as the Experiment is true.

23. There are two other Methods of Distilling acid Spirits, which differ only in the way of performing; for Example, a *Clyffus* and a *Gas* are acid Spirits as well as the former, but they are manag'd otherwise, a *Clyffus* is made in a tubulated Retort, and so is a *Gas*, you throw in any combustible Matter into a tubulated Retort heated,

to which a large Recipient is fitted, and suffer it to detonate, covering the Retort after the Matter is thrown in, and the acid Spirit comes over the Helm of the Retort, and enters the Recipient ; if the Recipient be empty of any Matter, the Spirit coming over into it, is call'd a *Clyffus* ; so Nitre and Sulphur detonated in a Retort, and received in the Recipient, becomes a *Clyffus* ; but if there be any Water in the Recipient, it is then call'd a Gas : So Sulphur detonated with any Body, and receiv'd into Water, is call'd *Gas Sulphuris*, for Gas is a Term used for any weak acid Spirit.

24. These acid Spirits in general are in use internally and externally, or are only design'd for the Solution of Metals or Testaceous Materials : The weaker Sort are given to cool the Blood, along with other Remedies, because they interpose between the oleous Parts of the Mass, and help to congeal it in a moderate Degree ; the more globular the Particles of the Blood are, the more readily do they split into minute Parts like Mercury ; but the les round they are, they touch in more Points, and cluster, and cohere and undergo more Friction, and therefore is the Blood retarded in its Motion, that is, the flower does it move forward, and the cooler therefore do we grow by their Use ; the purer Acids, such as *Aqua Regia*, *Aqua Fortis*, *Oil of Vitriol*, and the like, are only fit for external Use, and Surgeons use them as Cauticks, which make a white Eschar or a red one, or for the Dissolution of Metals and Stones : So *Aqua Fortis* or Spirit of Nitre dissolve Silver ; so Spirit of Salt, or any other weaker acid Spirit, such as Spirit of Vinegar, dissolve Coral and Pearl, and make with them the Salt of either ; how far these are useful is a Dispute, most repute them a vapid, useless Preparation, which

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can by no means be affirmed, because it really is a neutral Salt, partaking also of Vitriol, so that it cools and constringes, and is certainly good in choleric Diarrhoea's; first, because the neutral Salt corrects the Bile, and then because it corroborates the Mouth of the Glands by its Stypticity: They * who suppose * Lemery. these Salts of Coral and Pearl to act in the same manner as their Magisteries do, shew how little Skill they have in the *Materia Medica*; for in the Salts of these Testaceous Medicines, the watry Part of the Acid is evaporated only, but the Acid stays behind, and makes a *neutrum* or *tertium Quid*, which may be call'd a *Sal Enixum*, whereas in their Magisteries, the Salt or Oil of Tartar pour'd on, destroys the Acid that had dissolv'd them, and leaves the Body a mere *Calx* or Earth, which is void of all other Properties, save what Earths usually have. It is very manifest that these Bodies are not originally mere Earths, because they effervesce with any Acid; but it is as evident that they are nothing more after their Solution and Precipitation by the Oil of Tartar, because they neither effervesce any more with Acids nor with alcalious Drugs; they may then be made use of as Absorbers only, in which they cannot fail of being useful in a smaller or a greater Proportion, as they acquire smaller or greater Pores for this Purpose, which may in great measure be guess'd at from the Decrease of their specifick Gravity, Bodies being observ'd to decrease in that as their Pores grow wider, and to increase as they grow straiter, as is observ'd in hammer'd Metals.

25. The next Thing that we are to speak of, is *Chymical Oils*, which are principiated Bodies, as Chymists, are used to say, that is, they are a Composition of Oils and volatile Salts; they are

Oils, because they are inflammable, and they are Salts, because they heat with Acids in so violent a manner as to set the Oils on fire ; so that volatile Oils and Acids mix'd together do always flame up, thus Spirit of Nitre and Oil of Turpentine, or of Cloves, or any other essential Oil, will rise up in a Flame, even though the Oil be put into a Bason of Water : Moreover, we are convinc'd, that volatile Oils contain a Salt of the alcaline Kind, because if they are tossed in Water for a while, take a little Syrup of Violets and mix with this Water, and the Mixture turns green ; and again, if these volatile Oils be kept for any long time, they grow hard like Camphire, and prove themselves by this Hardness, and their pungent Taste as well as their Smell, to be volatile Salts : These Oils are call'd *Aetherial*, as also *Essential*, from Notions that are not at all groundless, because they are very fugitive, and even lighter than *Aether*, for they mount into our Nostrils, and fly off very quickly, and then they are stiled *Essential*, because they contain Principles of the active Kind, and do penetrate deep into Bodies, so that they enter into the minutest Recesses of the Vessels ; nay, it is observed, that these æthereal Oils continue their Virtues and Effects more efficaciously, and more durably, than pure volatile Salts themselves, because volatile Salts do suddenly impart their Effects, and do as suddenly fly off ; whereas the Salts are detain'd by their Cohesion and strict Union of these Oils to them in the Mass of Blood, and do more effectually attenuate and warm us : An evident Instance of this appears in giving Camphire to Persons labouring under a Malignant Fever, which is really preferable to volatile Spirits or Salts, as I have often experienc'd in that Case ; for whereas it may be granted, that a small Impulse per-

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petuates Motion, and that therefore a Blood upon the Point of standing still may be driven forward with these Salts for a while, yet the Effects of them soon vanish: Supposing then these volatile Oils to be equal in the Parts communicated, yet they excel in Duration, which Practitioners ought to be fond of, because our Intention is to find out a durable Dissolvent of the congeal'd Blood, which we have in these oily volatile Salts.

26. There is indeed a great Difference in these Oils, which is discover'd by their Weight, some of them being pitchy, sink and fall to the Bottom in Water, whilst others being lighter, swim upon it; so fares it with Balsam of Peru, Oil of Guaia-cum, Oil of Box, and all thick and black Oils, which don't ascend without a very strong Fire, yet they by a peculiar Management may be render'd light, for by redistilling them with any fix'd alcalious Body, they become light, which shews that these heavy Oils are weighty only, from the too great Quantity of essential Salt in their Composition; hence do they sink, which being once absorb'd by these fix'd Salts or Testaceous Powders, they become light as others: When therefore I talk of oily Salts, or saline Oils, I mean the light ones, which are void of any Acidity, and are highly impregnated with volatile Salts.

Butter of Antimony is a heavy Oil for many Reasons; first, because it is the oily Part of Antimony fix'd by the acid Salts which attract the Oil of Antimony more strongly than they do Mercury in sublimate, and then because they contain a large Quantity of the Mineral of Antimony, as appears by its turning into *Mercurius Vitæ* in Water, and its being then reducible again into Antimony; for if Oils be heavy and pitchy, and for that Reason

subside in Liquors, because they contain much Acid, how much more ought Butter of Antimony to be reputed heavy, when it contains much Earth, besides the acid Salts? To prove which, we may weigh it Hydrostatically, and easily be convinc'd how much heavier it is than the heaviest of vegetable Oils; as this is a certain Truth, so the same can be said of the Butters of Arsenick, of Copper, Silver, Iron, Lead, or Tin, all which do afford *Butters*, because they contain some sulphureous Parts in the Metal, which join in with the Acid, and become a *metallico-acid Oil*, that is, a heavy Oil that will subside in Liquors.

27. There are various Methods of gaining these æthereal Oils, which I shall as briefly as I can communicate to you: If you design to distil *resinous Bodies*, such as Labdanum, Mastick, Elemi, Turpentine, and such like, you take of the pitchy Body one Part, and of Water seven, eight, or ten Parts, and put them into a Retort of Earth to which you join a glass Retort, and you distil the various Oils, and a Colophony remains at Bottom, which is equivalent to a boil'd Turpentine, and is a good Agglutinant in the Whites, because it is an earthly Glue, that binds and gives a Stiffness to the relax'd Glands in any Flux: There is another Method of distilling these Oils from *resinous Bodies*, and that is, by taking one Part of the resinous Body and mixing it with three Parts of Sand, you put them into a Glass or earthen Retort, and fit to it a Glass Recipient, you increase your Fire gradually, and draw off your Oil: As Gums are apt to fwell hugely upon the Fire, Sand or Bole, or Brick Dust is very proper to mix along with them, because they hinder their Expansion, and swelling and bursting into Flames, which these combustible Drugs are apt to do; and it is

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observable, that the best Method of extinguishing these combustible or oily Bodies is to smother them with Sand: Hence, when Fire gets into Warehouses of Pitch, Tar, Rosin, or Oils, it were good to throw Sand into them in a plentiful manner, to prevent the Mischiefs about to ensue, which our *Fire-Offices* ought to remark. Another Method is by taking any *oleous Body* and mixing it in a Mortar with common Salt, and put them into a Retort or Still with Water, and by applying a moderate Fire, you gain the volatile Oil; this Method prevails in aromatick Bodies, and such are Cinnamon, Zedoary, Angelica, Elecampane, Mint, Rosemary, Galangal, Calamus Aromaticus, Juniper, Thyme, Spikenard, Pepper, Cassamunair, Lemon and Orange Peels, Cardamoms, Anniseeds, Cubebs, Cloves, Camomile Flowers, and such like: The Acid of the Salt detains some of the oily Parts, and hinders their Empyreumatick Smell; and thus according to their abounding with Oil and little Water, afford more or less. Another Way, and a very usual Method, is *in place of Salt to make use of the Spirit of Salt*, and it is mix'd with the Ingredient bruis'd or powder'd and put into a Glafs-Still, and the Oil is call'd over the Helm, and thus the æthereal Oil mounts, and the pitchy Oil remains at Bottom: In this manner you gain the most fragrant Oils from Cinnamon or any other, because the Acid keeps down the unpleasant and noisomely odorous Particles; and as in distilling Malt Spirits with these Acids you rob the Spirit of its disagreeable Smell, so it succeeds in distilling these Oils. There is yet another Way of obtaining fragrant Oils, and that is *by Descent*, as was said above, namely, they place two Pots one above the other, the highest perforated at Bottom, and luted to the lowermost, and the Top

or Lid of the highest is luted to the Pot that's uppermost, the Fire is set round the Pots, and the Oil goes through to the lowermost ; but this is done in Woods that require a strong Fire, such as Rhodium and some others.

28. Some Chymists have endeavour'd to rid these Oils of their Empyreuma, or burnt Smell, by *redistilling* them when once obtain'd, along with Water ; but ineffectually, for still the Smell continues : it were better therefore to mix along with Water some Spirit of Salt, or any other acid Spirit, and then we may gain our Point.

29. There are some Oils that are at first Distillation very thick and gross, yet upon Rectification, or upon a second Distillation, they grow thin and fluid, and such are Oil of Wax and of Tallow, and Oil of Olives ; but the two former at first give out a thick or sooty or buttery Oil, whereas the latter gives out a thin one, and leaves behind a Butter ; all which demonstrate an Acidity in great plenty contain'd in them, which however, by a strong Fire lose that Grossness, and become fluid, because along with them we mix any Body that will absorb the Acid that render'd it thick : Hence Brick Dust, Bole Armoniac, Chalk, Lime, or Testaceous Powders are put into the Retort, and as soon as the Butter melts at the Fire, the Acid attracts the Earth sooner and more powerfully than the Oil, and fixing there, the Oil becomes fluid, and where-ever any of this Butter remains, we make use of this Method till we obtain all the Oil pure and unmix'd : Thus it is we can conjecture how much Oil there is in any Body, because by distilling and redistilling very frequently, the Oil at last comes off very pure.

30. As to the Virtues of these Oils, they are reputed to be Saponaceous, and to disengage any

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Adhesions, whether of a grosser Fluid to the Sides of Vessels, or of an extraneous Body to them, or of one solid Part to another; thus where Phlegm sticks to the Lungs, and cannot be freely spit up, we give any Oils to glib the Vessels, and up it comes; thus also if Bile be congeal'd to the *Ductus choledochus*, and so bungs up the Orifice of it, Oils will disentagle the Matter adhering, and it will slip off in time: In like manner, if a Stone sticks to the Lungs, or Bladder, Gall, or Kidneys, we give these oily Substances to break off this Adhesion, and to make it glide off. Lastly, if there be any Parts that cohere together, that by Nature should not, Oils are proper Remedies to destroy this Cohesion; for Example, suppose a Bone should be broken, and should be set wrong, if a Surgeon has a mind to reduce this into a better Position, he makes use of Oils or oily Medicines first to disunite this Juncture, and then reduces as he judges proper; an odd Example of which I remember to have known in a certain noble Person, after he had try'd all Assistance that *London* could afford him: They are reputed Vulnerary's, particularly those of the grosser and heavier Sort, such as Balsam of Peru, and Oil of Guiacum, because they abound in glutinous Parts; and as Ulcers of the Bowels proceed from acrimonious Salts corroding the Fibres, these by their inviscating Power sheathe and prevent the Effects of such Salts, and agglutinate. But to say the Truth, we very rarely ever find that there is any Cure, save a palliative one for ulcerated Bowels; indeed, if the Lungs are slightly ulcerated or wounded, or if there be slight Ulcers in the Kidneys, Bladder, or Urethra, these Balsamicks do assist greatly. The light and volatile Oils are Cordial, as I have already hinted, forasmuch

asmuch as we can discover, the Spirits are of a like nature with them, or however are greatly recruited by them, and therefore do we administer them in their Wastings ; all of them are Carminative, but many of them are peculiarly so, for to force off Wind is the Effect of elevating the Mass, and dividing it so as to break the Bubbles, and then the elastick Parts escape. Of their further Virtues more shall be said in the Oils subjoin'd.

31. There are some of these Oils extremely fetid, such as Oil of Amber, and the like, which are distill'd in the same Manner as the other essential Oils ; they are reputed hysterical Medicines, because they recruit the Spirits, but they are of so noisom a Smell, that few make use of them.

32. *Sublimation* is throwing over dry Substances into a Receiver, by the Force of the Fire, as *Distillation* is a carrying up Liquids by the same Force: The Fire acts according to the Nature of the Body put into it; some it throws up with Force, and these are light and subtle Particles, that ascend in the Form of Smoak, and descend again into the Receiver in the Form of Rain or Powder crusted upon the Sides of the Vessel ; others it rolls about and melts, as Metals and such Things as are of an homogeneous Nature; and others it cannot move at all, such as Diamonds of any sort : The Causes of which are either the greater Levity or less Gravity, or the Cohesion of the Particles, or the Porosity of the Body, for Diamonds seem to transmit Fire as readily as they do the Rays of Light, nor does the Fire ever melt them, only takes off some of their lighter Parts, and makes them weigh less; for if you put Diamonds into an open Fire without any Cover over them, they lose their polish-

polishing, so that they must be work'd over again, therefore it shaves off their Surface; but if you cover them over from the Access of the Air, there is no occasion to repolish them: It is an avow'd Maxim with Chymists, that whatever can be turn'd into Ashes, or, as they term it, whatever can be incinerated, will vitrify, or turn into Glass; wherefore if the Loss of its Surface may be call'd a partial Incineration, there may be found a Method to vitrify Diamonds, which would be a Secret of a high Nature.

33. Where Particles cohere slightly, as in Benjamin, and some other Gums, in Sulphur, and such like, they sublime without any Addition at all; but where the Cohesion is greater, they stand in need of some Addition to destroy it, as will appear in the several Preparations here under to be mentioned.

For Example, in Salt Armoniac, we untie the Bonds that keep the Salts together, by Steel, which attracts and licks up Part of the Acid in the Salt, and then the Volatile mounts up gently mix'd with some Acid to make the Flowers, which by their yellow Colour seem to partake of the Steel also, and as this is perform'd by Iron, so the same happens with Salt of Tartar, which after it has separated the volatile Salt and Spirit from the Acid, by a strong Fire it forces that Part of the Acid which is yet not let loose, to fly up into Flowers which are partly volatile, partly acid; so that these Flowers are only Salt Armoniac purified.

34. These Flowers or sublimed Powders take such Place in the Receiver, as their specifick Gravities will allow, wherefore some of them of a lighter Nature will stick to the Bottom of the Receiver, whereas others of them will hardly

pass beyond the Neck of the Retort ; hence Sub-limate Mercury mounts up to the Top of the Alembic, whilst Cinnabar sticks at the Neck, but *Mercurius Dulcis* mounts higher than Cinnabar, but not so high as *Sublimate*.

35. Metals therefore are of their own Nature very fix'd, nor can they be sublim'd into Flowers, unless we can destroy their Cohesion, enlarge their Bulk, or lessen their Gravity, then indeed they will ascend ; thus the Flowers of Steel or *Ens Veneris* are made out of Steel ; these Flowers do really partake of the Iron, as appears by their Colour and their stypticke Taste ; in like Manner Silver, and even Gold itself, can be lifted up into Flowers : And what is the *Aurum Fulminans* put on the Fire, and kept there till it thunders, but the Flowers of Gold, that fly off all at once ?

Quicksilver is heavy indeed, but then, as far as we see by it, upon the least Touch it is divisible into Globules ; from whence it appears, that in its component Parts it is spherical ; and as the Contacts of Spheres are punctual, according to *Euclid*, or do only touch in a Point ; wherefore whenever a Sphere is surrounded by many Spheres, their Contacts with each other are only in so many Points ; hence as Cohesion is in Proportion to the Contacts of Bodies, Spheres touching in fewer Points than any other Figures, they must cohere less, and must therefore by any Impulse be more readily separated than other Bodies, and consequently be more easily sublimed than those other Bodies ; moreover, as they are divisible into very minute Raments, they lose of their Gravity, and upon this Account also does Mercury mount up more easily.

36. There are then certain Measures whereby the heaviest Body can be made volatile, and be
made

made to mount up, by such Additions as lessen the Gravity or Cohesion, or increase their Surfaces.

37. Flowers are dry Powders that mount by the Assistance of the Fire, and are partly metallic, partly sulphureous, some acido-salines, as will appear by their different Opposites; for where any of them are so strongly sulphureous as to be extremely dangerous to be given inwardly, Acids stop their ill Effects; thus Flowers of Antimony do so disturb the Stomachs of such as take them, as to throw them into Convulsions, yet by giving Cream of Tartar, or any gentle Acid, we suppress their Effects quickly, and Antimonials are found to be castrated of their rough Quality by Acids; but there is a Peculiarity in this Affair not as yet much observed: It is granted, that Antimony acts by its sulphureous Parts acuated, and the Flowers shew us that they are such a Sulphur, because they will flame away into the Air. Now Sulphurs may be render'd either corrosive, or may be render'd mild with Acids, as they are managed; and this appears evidently in our Antimonial Preparations; for if we add the milder Acids to fix the Sulphurs, they become gentle, as they do by exhaling or calcining them; but if we intimately unite them to strong Acids, they become Fire itself: Otherwise, how comes it to pass that Antimony is render'd a strong Caustick with Spirit of Nitre, and yet is render'd a Diaphoretick by Calcination, so that the Regulus, which is vomitive, becomes by farther Calcination Diaphoretick Antimony, and is curb'd of its violent Effects in vomiting by a little Cream of Tartar, or any gentle Acid? Some of them are received in a Cone of Paper, as those of Benjamin, and other Gums; some of them in Straw,

Straw, as is said of Camphire; others in *Aludels*, as Flowers of Brimstone and of Antimony; others in an Alembick, as Cinnabar of Antimony and Mercurius Dulcis, as also the Flowers of Salt Armoniac; however, I have often sublimed Cinnabar in a Retort; and all of them may be sublimed the same Way.

38. The Sublimes or Flowers are these following, namely, Flowers of Sulphur, of Benjamin, of Salt Armoniac, of Antimony white and red, of Arsenic, of Sublimate, of Mercurius Dulcis, of Ens Veneris, of Bismuth, of Tin, and of Amber call'd Salt of Amber, and the like, of which anon.

39. The last is that of distill'd Waters, which differ extremely in their Natures, some are mere Element, others are stock'd with Spirit, and others again with Salts; but then these Salts are only volatile ones; for as to Rain-water or Dew, which the antient Chymists made use of for Distillations, they afford nothing but Element, the Nitre they are supposed to contain does not mount; and if Salt-petre can't be made in a Garret, why shall we suppose it done as high as the Clouds? They are distill'd in various Instruments, according to their Nature; when we expect mere Element, and we do no more from Plantane or Oak-buds, then a *Balneum Mariæ* suffices; if we expect spirituous Waters, such as *Aqua-mirabilis*, *Doctoris Stephani*, *Pœoniæ Composita*, *Cinnamon*, and such like, then an Alembick and a Worm exalts them; if we expect volatile Salts, or volatile oily Parts, as we do from the Tips of Hartshorns, from Swallows, Fox Lungs, Oxes Spleens, and such like, are got in a *Balneum Mariæ*, or an Alembick.

40. As for Waters distill'd from Minerals, nothing can be expected from them, and therefore is it lost Labour to distil them, for they are too dry to afford above a twentieth Part of Water, and when that is got, it is pure Element; if we carry the Fire to any Height, then their acid Parts arise; and who would labour for a Ros or Phlegm? If the Fire be violent, it surely contains some Acids among the Water afforded, which make a sort of Gas, or Water diluted with a small Quantity of acid Spirit.

41. Spirituous Waters are made from Wine or Ale blended along with the Ingredients, and infused for some Time, and then distill'd, but aqueous Waters are blended with Water, and so call'd over the Helm.

42. Some distil Rose-water, and a few more *per Descensum*, tho' this is neither usual nor necessary.

43. Therefore they who promise themselves any thing more than Spirit, Water, or volatile Parts, are deceived; for Minerals afford none, and therefore that Vinegar of Antimony, which some have boasted of, is a mere Chimera; for the Antimony gives out nothing to the *May Dew*; we have Difficulty enough to get its Clyffus, and even that may be doubted, as we manage it, to be the Spirit of Nitre only.

44. *Rectification* is a second Distillation, or Sublimation; when *Spirit of Wine*, for Example, has been obtain'd, we recommit it to the Alembick, and call over a fourth Part of it, and that is call'd rectified Spirit of Wine, one third more is good Brandy, and the Remainder is nearly Element; upon the first Distillation or Sublimation, there are several Parts which ascend mix'd together, as in these Spirits the Water, and more with

with less rectified Oil, as in volatile Salts we find Oils blended with them, that spoil their Colour, and so of the rest.

45. *Cohobation*, as has been hinted under the Terms, is a reiterated Distillation, where what is fix'd is render'd more volatile, by blending somewhat that is volatile along with some fix'd Body that will detain its more earthy Parts.

46. You are to observe, that there is a wide Difference between Rectification and Dephlegmation of a Body; in the latter the aqueous and insipid Parts are made to mount into the Receiver, as may appear upon two Instances; first, the Phlegm appears in the Receiver in the Shape of Drops, and when tasted it is properly insipid, and without Smell, whereas the spirituous Parts have both Taste and Smell in an eminent manner, and mount up in fine and almost invisible Steams: Phlegms or insipid Waters have little or no Efficacy, but Spirits have great Virtues; nor can Water, very properly speaking, be call'd Phlegm, only those may be call'd such, as congeal with Cold into a smooth Substance.

If we would take off the unpleasant Smell from Brandies, we have two Methods, both of which prove effectual; first, we distil the Brandy off from odoriferous Gums, such as Benjamin, Amber, or Mastick, and the like, and it mounts up of an odoriferous and agreeable Scent, and loses its former; however, this gives a Suspicion of some Adulteration, and therefore ought not much to be follow'd by common Distillers; but the Method which I spoke of before, namely, by mixing fix'd Salts of Pot-ashes, of Tartar, of Salt-petre, and the like, along with some Lees of Wine, we temper all the fetid Smells, by not suffering the burnt Oil to ascend, or by putting in

in Spirit of Salt, or any acid Spirit into the Still, we destroy that ill Scent, and fix that Oil like a Pitch at the Bottom of the Still.

47. In the Rectification of *Vinous Spirits*, we ought to continue to distil while Streaks appear in the Alembick; for when Drops appear, then comes the Phlegm, and when partly Streaks, partly Drops appear, a Mixture of both ascends; so that if we expect nothing but pure strong Spirit, we distil no longer than when the Streaks begin to be mix'd with Drops; for you must observe, that in the Rectification the lightest mount first, therefore the Spirit mounts before the Water; but the contrary happens in the Rectification of mineral Spirits, because they being heavier than the Phlegm or Water, and nothing besides hindering their Ascent, they mount last of all, and such as are all Salt, or nearly divested of any other Body, don't mount without a strong Impulse of the Fire; which carries up even metallic Parts along with it. These Spirits are put into Motion, and let go their incohesive Parts, that is, the watry Parts, very readily, which whilst the Fire is small and evaporatory throw off nothing but Water; but when increased to a certain Degree, then also mount up some lighter Parts of the Acid, and this is what is properly call'd the *Ros*, and in this there is some moderate Virtue in Proportion to the Quantity of the Acid contain'd, however, not equal to the Effects of Vinegar, and I am of Opinion we may neglect them intirely, when we can impregnate common Water so readily to what Degree we please: To know how far this *Ros* has any Degree of Acidity in it, we mix a little Salt of Tartar with it, and we discern a Huffing and Turbidness proportionable to the Quantity contain'd.

N. B. A distinguishing Mark to know whether they are truly and sufficiently rectified, is, by mixing Gunpowder and the Spirit together, and setting Fire to the Spirit of Wine, if when the Spirit is dryish and near the End, the Gunpowder flashes, they are then truly rectified.

48. *Volatile Salts and Spirits* also grow purer and stronger by being rectified ; the Salts grow whiter indeed, but it is much doubted whether they grow more efficacious thereby, because the more they are exalted by this Resublimation, the less Oil they contain, and the more irritating are they, and the less able are our Nerves to bear them ; whereas if you don't quite rob them of their Oil, they attenuate more gently, and they become therefore more consonant to our Nature, and less caustick, which they really are, if they be too much concentrated or rectified, as may be seen in Salt Armoniac made with Lime, which becomes only proper for external Use, and for smelling at ; for it will blister the Tongue, if touch'd by it.

49. *Oils* are also *rectified*, or *redistill'd*, and they become thereby more thin and volatile ; if Oil of Wax, which is a thick and buttery Oil, becomes thinner by redistilling, what is not to be expected from Rectification in other Oils ? A pitchy Oil then becomes thinner and more volatile by the Fire ; so that the last and heaviest Oil is made lighter thereby : Therefore the Fire destroys the Acid that render'd the Oils gross, and if we rectify these Oils by mixing them with alcalious Drugs, such as Salt of Tartar, Pot-ashes, Chalk, Lime, and the like, it will succeed yet much better : For in these Oils there are certain Degrees of Tenuity known by their Colour, the white is the lightest, next to that is the yellow,

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the next in Gravity is the red, and the heaviest of all is the black and pitchy Oil, now all these Oils mount in the Order herein mentioned; if therefore we can bring the blackest Oil to be clear and without Colour by the Fire, or Additions of fix'd Salts, we rob them of their Acidity by either Method, and render them thereby more fit for Use: Thus if Oils become rank by Age, we need only mix a little Lime or Pot-ashes with them, and recommit them to the Fire, either with some small Quantity of the fresh Vegetable, or without it, and they come off fragrant and well scented: Again, suppose we distil any Oil from an odoriferous Body, such as Marjoram, or such like, and it should fail of being fragrant, you by mixing it with Water and Redistillation will render it very white and fragrant, because Water with Heat washes off the Acid that render'd it red or black; or lastly, if we mix common Salt decrepitated with the Oil, and call it over again, we shall render it white, for this is a sort of an alcaline Body, and absorbs the Acidity: Lastly, Sand itself will answer the End; so that there are several Ingredients for the Rectification of Oils, namely, Alcalines, terreous and watry Bodies, these either detain, dilute, or destroy the Acid that heighten'd their Colour.

50. We obtain a strong *Spirit of Vinegar*, if we rectify it upon crude Salt Armoniac, Salt Gem, or common Salt; for Example, if we take eight or twelve Parts of Vinegar to two or three of Salt Armoniac, or of common Salt, and call over the Spirit; thus it is in making Aqua Regia, for any of these three Salts do imbibe the watry Parts of the Aquafortis, and render it so concentrated that it will dissolve Gold, and the same happens here, the Salt Armoniac, &c. make a

Diminution of the Water, by making it fly off in the Ebullition, and here the Phlegm is made to exhale more readily, and the Vinegar grows sharper thereby: For in rectifying P. 28. *Mat. Med.* Spirit of Vinegar, a Water slightly impregnated with Acid ascends first; next ascends Vinegar; lastly, at the Bottom remains a very strong, heavy, and sharp Vinegar, and the more Water is taken off, the sharper will the last Vinegar be: There is this Difference between Spirits of Nitre, of Vitriol, and others, and that of Vinegar, that those have no Oil, whereas Vinegar has. This Acid arises upon a small Heat, as appears in the Exhalation of Sea Water, which by a gentle Heat gives out nothing but Water, but by a Heat equal to that in Summer, gives out also a gentle Acid, and it is this Heat that causes living near the Sea-shore to be so productive of the Scurvy.

51. Rectification is also made by *Concentration*, which is perform'd several Ways, for the Sailors have found out in *Nova Zembla*, that Wine may be converted into Brandy, and that into Spirit, merely by the Power of Cold, the Force of which converts all the Water in Liquors into Ice: this Mr. Boyle has communicated to us, and to him we are obliged for this Discovery. Another Way which is spoke of by *Homberg*, is, by adding fix'd Salts or alcalious Bodies to any acid Spirit, and then by evaporating gently, the Water mounts into the Air, and leaves the alcalious Body and the Acid behind, which last if we have a mind to obtain, we make use of a strong Fire and call it off, altho' *Glauber* makes a Mixture of distill'd Vinegar and Salt of Tartar, and if he would obtain the concentrated Spirit of Vinegar, he adds Oil of Vitriol, and then by a gentle Heat

Heat he regains the Vinegar highly pure; but the Reason of this is, because it is known that whatever Vinegar has dissolv'd, Oil of Vitriol precipitates; wherefore the Salt of Tartar, which had been dissolv'd by the Vinegar, is join'd to the Oil of Vitriol, and the Vinegar is let loose to ascend readily: By this Method of Concentration we come at the Knowledge of how much acid Salt is contain'd in any acid Body: we know, for Example, that Vinegar to the Quantity of ten Drams and a half, only contains eighteen Grains of an acid Salt, and so of all others. Another Way to concenter Spirits, is, by adding to them earthy Bodies, and by exhaling the Water gently, then by Distillation we call off a pure Spirit; so to Acids we add Filings of Iron, of Bole Armoniac, of Lapis Calaminaris, of Marle, or the like: The last and most usual Way is by Distillation and Rectification; this the Chymists do daily practise, as the easiest and cheapest Method of all.

Of CALCINATIONS.

52. There are many Methods of Calcination; however, we are said to calcine a Body in a large Sense, whenever we can reduce a solid Body into Powder.

53. Under this Head will come the Method of rendering any Body fix'd that is volatile; thus if we cou'd, as we have not, find out any Method of fixing Quicksilver, so as that it never should return again to its pristine Form, it would be a Secret equal to that of making Gold, because if there be but three or four Grains Difference in specifick Gravity between Gold and Quicksilver, and if Quicksilver contains many heterogeneous Parts that can be separated, as appears,

and if it can be colour'd, as is easy, and if it can be fix'd, in which the whole Difficulty lies, then there would be no Difference between Gold and Quicksilver so managed: But when we have done all we can to fix it, by the Fire or Additaments, it resumes its former liquid Shape; and the same may be said of Antimony; the Butter of it, we all know, is obtain'd by the Fire, and yet by an Addition of Spirit of Nitre it is precipitated into Bezoar Mineral, which shews us that the Mineral Regulus is only dissolved in the acid Spirits of Vitriol and Salt, and is at last precipitated by the Spirit of Nitre.

54. There is a Method of fixing acid Spirits, namely, when we take any fix'd Salt and pour on to it any acid Spirit, till they have done fermenting, then we dry the Salt and powder it; this is the *Sal Enixum* of the Chymists, and in a large Sense may be term'd a Calcination.

55. Some Bodies that appear liquid may at last be reduced into a Powder; so Mr. Boyle has made us see, that Water distill'd ever so often did always afford Earth at the Bottom of the Still; there is no doubt but Water contains a great deal of Earth, and as the Fire destroys the Cohesion of the Water, those Powders, which were suspended before, must fall as the Water grows purer; but then Mr. Boyle makes an ill Consequence from this, as well as from many other Experiments, which I refer the Reader to, for Brevity sake; for he supposes that Bodies can be transmuted into others, which may be proved to be an Impossibility by many Experiments.

56. *Calcination* is properly made by the Fire, or by the Fire and some additional Bodies; so Alabaster, Limestone, or other hard Bodies are made Lime by the Power of Fire alone; but all Magi-

Magisteries are prepared by the Fire and some Menstruum added to them; and where a Body is calcined by the Fire only, there nothing is left save the terreous and fix'd Salts behind, all the active Parts, namely, the fugitive, the volatile, the sulphureous, and the rest, are exhaled and carried off.

The Fire in calcining Bodies does certainly add some Particles to them, which Calcination by Burning-Glasses does not, and even takes away; hence *Febure* assures us, that if Antimony be calcined by the Sun from a Burning-Glass, it makes a Regulus sooner than a common Fire does, and this *Regulus* is not vomitive, but dia-phoretick. The Force of such a Calcination has lately appeared to be quicker and greater than that of a common Fire, because Gold and Silver could never be vitrified till this Manner of calcining was try'd and found out; since when, it has been seen in *England* that such a Glass calcines Bodies in an Instant of Time: however, it is certain that we have not fully been able to exhale every acido-sulphureous Particle from Earths, as appears in Arsenick.

57. Calcination sometimes decreases, and sometimes increases the specifick Gravity of Bodies; and where it lessens it, there it increases them in Bulk; so in the Calcination of Iron it enlarges its Surface extremely, but then it loses of its specifick Gravity in Proportion; but where it increases this Gravity, there the Bulk of Course is less, as in the making of Glass, or in making Iron into Steel with Horns stratified, they loosening the Sulphur, it exhales, and the Steel is heavier. Iron grows Steel by extinguishing it in Alum or Salt Water, and by hammering, as well as by Horns. So that one may say, that a Demi-Calcination decreases the specifick Gravity, and

enlarges the Bulks of Bodies, but a perfect one has a contrary Effect, because the Fire exhales all the lighter Parts in a full Calcination, not so if half calcined ; and the harder is the Body from whence you make the Calx, the more hard and durable is that Calx ; Marble then is one of the strongest Calx's.

How the Weight increases is somewhat difficult to explain ; for if Weight corresponds to the Quantity of Matter, then the Weight ought to decrease, because Part of the Quantity of Matter flies off, yet it is very plain that one Pound of Lead calcined gives one Pound and two Ounces of red Lead ; the Gravity of the red Lead is less specifically, but absolutely heavier, therefore somewhat is added, which I take to be the Pressure of the Air, that increases with the Surface of the Body, for the same Body weighs more in a deep Pit than at the Surface of the Earth, with an Addition of Fire.

58. In Calcination the Fire is made very intense and reverberatory, as we see in the Calcination of Metals, and even in Lime itself ; as for Metals, most of them will not run but by the strongest Heat, and thereby not without a reverberatory Fire.

59. Bodies of any fix'd Nature do hardly run without the Addition of some Flux Powder ; so Iron runs with Brimstone, and this Brimstone, or Arsenic, or Sublimate Mercury, or Zink, or Verdigrease, or Salt-petre, or Borax, or some such Bodies are generally made use of in the Calcination of Metals, as will appear anon.

60. Salt-petre is generally used with Bodies that are sulphureous and will detonate ; thus Antimony and Arsenick are detonated with Salt-petre, and makes *Antimonium Diaphoreticum* ; if Arsenick, a Caustick, which is fix'd in a Crucible, or

or if Antimony is detonated in a tubulated Retort, we gain the Clyssus of Antimony, the Flowers of it, and the Antimonium Diaphoreticum altogether; the latter is our chief Aim, the others being very little in use, nor is the Diaphoretick Antimony itself much in use in *England*.

As Diaphoretick Antimony is very white, and is a Calx, it may be made use of as common Lime or Whiting for Walls, particularly when Houses are plagued with Bugs, because this Powder becomes vomitive by being exposed to the Air, and therefore its Steam will prove offensive to these Creatures, and the Bezoar Mineral is yet more effectual in this Case, being made with a strong acid Spirit; altho' these two Preparations are nearly for one and the same Use, they being only Antimony prepared with Nitre different Ways.

Calcination has the Effect of taking off corroding Salts, and of rendering Bodies much milder; so Bezoar Mineral being made by Spirit of Nitre pour'd on Butter of Antimony, and by Calcination, grows a mild Remedy, for two Reasons, first, because this Spirit effervesces with the two Spirits that make up the Butter, and after the Struggle they unite together, and are disengaged from the Regulus; then in the Calcination all or most of the acid Spirits mount into the Air, and leave the Antimony free of them, besides, the oily Part flies off also, so that the Antimony is left a mere Calx fit to absorb Humours: This appears to be the genuine Reason of this Effect; for Spirit of Wine also robs *Mercurius Vitæ* of its harsh Qualities, as well as Calcination, which shews us that the Parts exhaled are acidofulphureous, which are noxious.

They who contend that the Effects of Iron are produced by the Salts of it, as *Lemery* does, judge

judge right to prefer Iron to Steel ; but they who ascribe the Virtues of Steel to its Gravity, as *Sennertus* and most Moderns do, do well in admiring hammer'd Iron or Steel ; but as both hold good, the Prescriber must chuse the one or other, according to his Intentions.

61. There is a Method of Calcination call'd *Cementation* ; it is design'd for the Calcination of Metals, and for refining them, and therefore it is made use of principally with Dealers in Metals ; the Chymists burn Brasses in this Manner by stratifying Brass and Brimstone ; they also make Vitriol of Copper by Cementation ; they also turn Copper white by stratifying Arsenick or Orpiment with it, and there is a Paste which is call'd the Royal Paste, for purifying Gold : In this Operation the third Degree of Fire is required : And if we would prevent the running of the Metal, we must add Salts and earthy Powders.

62. *Decrepitation* is a Species also of Calcination ; for the Salt is kept upon the Fire till all its Humidity flies off, and the Salt is kept there till it be quite dry : Not only Salt, but Alum and Vitriol may be calcined to a Powder ; there is one Circumstance observable in Alum, and that is, if you design that it should become corrosive, it must not be calcined in an Iron Pot, because the Acid would leave its own Earth, and be attracted by the Iron more strongly, and that calcined Alum would be a mere *Terra damnata* ; the same may be said of Vitriol.

63. There is another Calcination of Bones, when, for Example, Hartshorn is burnt till it becomes first black, and lastly white, and this is a Preparation highly esteem'd in Fevers, in Worm Fevers, and in all Fluxes of the Belly ; Ivory is also burnt in this Manner, as will be seen anon ; thus

thus the earthy Parts are only left behind, which is partly alcaline, partly a porous Earth.

There is one Caution to be observed in calcining Bones to a Whiteness, namely, you can never bring them to a Whiteness if they are cover'd close up from the Air, because if they are cover'd close, the sulphureous Parts join'd to an Acidity are retained and circulated upon the Bones, and thus in distilling Spirit of Hartshorn the Bones at Bottom do never become white, but continue black; but if you calcine them in the open Air, these Parts fly off and leave the Bones white: This Caution is not only true in Bones, but also in all other Cases, for Antimony calcined in a close Crucible will remain black, whereas in an open one it is white, and the Reason is the same.

All Glass whatever is made by Calcination, save the green Glass of Arsenick, which without any previous *Encheiresis* is made by Sublimation only; the Reason of which is, it is not an Earth, but a corrosive Salt, and therefore it is not Glass, but Flowers resembling Glass.

64. Vitrification is also a Calcination, by which Ashes are turn'd into Glass; this Operation is not perform'd without a vehement Fire; it is to be observ'd, that nothing can be turn'd into Glass but what strikes Fire with Steel, or will first be calcined into Powder, and therefore Gold and Silver by the ordinary Methods can't be turn'd into Glass, altho' the *Lens* invented by *La Vriellette* or *Tzirnbause* will effect it; which shews what was advanced before, that concentrating the Fire into a Point acts more forcibly than when it is widely diffused: The common Method at the Glass-houses is, by taking any sort of Ashes, Flints powder'd, Sand, Chalk, &c. and mixing them with any Ashes abounding with a fix'd

fix'd alcaline Salt, and so committing them to a strong Fire, and they turn into Glass: There is a very little of the fix'd Salt that runs into Glass, the other Powders are the proper Materials for it, however, the Salt helps the Fusion, and exhales the more oily or volatile Parts, and leaves its Earth also pure behind, which being equally dense in all its Parts, becomes transparent.

Some Earths will not vitrify, because it is hard to rob them of their Sulphureous Parts; for Example, Iron is hard, if at all, to be vitrified, and if the Glass-makers mix any Quantity of Iron with their Ingredients, they will not turn into Glass.

65. This Operation is the last Resolution of Bodies; we can go no further with any Body than to reduce it into Glass; it cannot, as far as we know, be done with all Bodies; only if we can bring a Body to become Ashes, we may vitrify the same; nay, some Bodies may without this Circumstance be made into Glass, as appears in Glass of Antimony, which must first be gently handled by Calcination, and then afterwards must be fused strongly, and then it turns into a pellucid Body call'd Glass, unless some heterogeneous Sulphur be conjoin'd with it, or by Mismanagement it turn into a Reguline Substance; Sulphurs blended with Bodies do hinder Vitrification: This Glass of Antimony is very emetick, whether it be infused in Wine, Water, or in any acid Syrup or Juice.

The various Methods of Reducing Bodies to their Original Shapes.

All Metals except Quicksilver can be revived or reduced into their pristine Shapes by absorbing the Acid with any fix'd Salt, and by using a strong

strong Fire, as appears in the following Instances; for the Acid only destroys the Shape, and that being overcome by any fix'd Salt, the Fire smelts the Metal back again; but Quicksilver only bears Distillation.

Crocus of Iron may be reduced into Iron again by a strong Fire, as Earths that have a Redness in them may.

Luna Cornea is not reducible into Silver without Lead, a violent Fire, and the Bellows.

Silver may be had from the Ore by three different Ways, to wit, by Aquafortis, by Quicksilver, or by Glass of Lead.

Copper is reduced by mixing Salt-petre and Tartar along with the Powder, and giving a violent Fire; for Copper does not melt without a very strong Fire, unless some softer Metal be join'd, as Tin melted with Regulus of Antimony, &c.

Lead is revived from *Saccharum Saturni*, by making use of Salt of Tartar and Fusion, or from Spirit of Lead there rests a black Powder at the Bottom of the Still, you take this Powder, and put it in a Crucible over the Fire, and it returns to Lead without Salt of Tartar.

Silver is to be reduced with Salt-petre and Tartar, and its Calx by Fusion.

Gold is reduced by Salt-petre; *Aurum Fulminans* by deflagrating with Brimstone is reduced.

Tin is reduced by a gentle Fire along with any Flux Powder, as Salt of Tartar and Nitre fix'd, or with Peat-Turf, and Charcoal alone.

Mercury in *Cinnabar* is reduced into running Quicksilver by mixing the Cinnabar along with

with Iron in Powder, and by subliming it into a Recipient half full of Water, or by mixing it with Lime and Subliming, as is said and will be seen ; and as *Æthiops Mineral* is, as we may say, the Embryo of *Cinnabar*, being to be made into *Cinnabar* by Sublimation, the Mercury can be reduc'd from it in the same manner as from *Cinnabar*.

Glass is return'd to its Principles by melting Glass and Pot-Ashes, of each equal Parts, melt them, and pour them into warm Water, the Salt mixes with the Water, and the Sand subsides ; or mix powder'd Glass with Sand-ever, put them in a moist Place till they turn to Water, then pour on *Aqua Regia*, and the Sand settles to the Bottom, while the *Aqua Regia* mixes with the Sandever ; and Crystals themselves may be reduc'd by Calcination and Immersion in a Lixivium.

66. Common Glass and Crystal Glass differ in their Materials, the latter being made of a finer Matter than the former ; Green Glass being made of Sand and Fern Ashes, but the latter of Pot-Ashes and Flints, or finer Sand ; but the finest Glass of all is made of imperfect or perfect Metals : So Cobalt and Lead give a fine Glass. Lead smelted with calcin'd Flints becomes also a fine Glass, and Cobalt smelted with Sand gives a blue Glass, as shall be seen.

67. In making Cupels, Calcination has the sole Hand, and great Art is required in making them. The Stuff they are made of hardly vitrifies, or however, it makes a dirty and obscure Glass ; for as Cupels are made of Animals Bones, and their Earth is not equally dense, they scarce become transparent : Possibly the various Nourishment Animals take, may make them a Composition of hard

hard Parts taken from various Bodies, which do originally vary in their Densities. It might be here proper to discourse of the Varieties of Earths; how, for Example, one is denser than another, one more ductile than another, one more apt to run, and so forth: But as this Speculation would take up more time than these Pages will allow of, I leave it to others more at Leisure.

68. Thus we see that *Reductions* and *Revivifications* are generally perform'd by *Calcinations*; what is meant by these Terms I need not explain. Thus Silver is brought from its Preparations into Silver again, by putting a little Wax and Tallow into the Cupel or Crucible along with the Preparation, whatever it is, and using a strong Fire, which otherwise would fly up into the Air; for the Salts, that metamorphose it into the Shape it has, give it Surface enough to be lifted into the Air by the Impulse of the Fire, but these sulphureous Bodies, and the acid Spirits attracting each other more strongly than the Metal, the Fire returns the Metal into its former natural Shape; the same may be said of the Gold, in that Preparation call'd *Aurum fulminans*, which being placed on a Fire upon any thing, flies off with a Noise into the Air, yet if we take Brimstone and deflagrate this fulminating Powder with it, the Metal returns to its former Shape, because the Sulphur attracts the *Aqua Regia*, and the other Salts, stronger than the Gold, so that the Gold is freed from any extraneous Body, and returns by the Force of the Fire; and indeed, most are reducible from *Glaſs*, or any Preparation they have undergone with Bodies that contain sulphureous Parts; thus Lead, Copper, Tin, Antimony, or its *Regulus*, Bismuth, and such like, are reduc'd by Rosin, Soot, Powder of Coals, Tartar, Wax, Tallow, and the *black Flux Powder*, which is a Calcination of Tar-

tar

tar and Salt-petre together; thus when Lead is blown into Litharge, as some Artists do to get the Silver out of it, it is reduc'd into Lead again in *Holland* with Tallow; thus also the Regulus of Antimony, and its *Scoriae*, are reducible into Antimony again, by common Sulphur and the Powder of Coals. Alcalious fix'd Salts, the less refin'd they are, or the less they are clear'd from their Oil, or the browner they are, have a greater Share in the Reduction of Metals and other Bodies; this Reduction is done in a wind Furnace or Flew, and the Metal is stratified with the sulphureous Body, and made to return.

69. There are two things which destroy the Shape of Quicksilver, namely, acid Spirits and Sulphur; and this they call the Mortification of it, or killing it; so much does Sulphur kill Quicksilver, that the Balsam of it is the readiest Method of extinguishing it: So that Surgeons, who deal much in Salivations, cannot better divide it for mixing it with their Ointments, than first by extinguishing it in this Balsam made with Oil Olive, and then to add what Ointment they judge most proper to make it up with; and as Quicksilver can be chang'd into so many different Preparations, I shall shew you how to reduce it from several of them into running Quicksilver again; for Example, Mercury sublimate may, according to Mr. *Boyle*, be reduc'd or reviv'd, by mixing it with Filings of Copper and crude Salt Armoniac, and holding it over a Candle or Fire in an iron or bras Spoon: Nay, I have been inform'd by a Gentleman well vers'd in these Subjects, that a certain cried-up Arcanum for the Pox has been thus revived into its native Form, after having been asfured by previous Trials, that the Preparation was only red precipitate Mercury.

70. Mercury sublimate may also be revived by adding Filings of Steel, Salt of Tartar, or Quicklime, or Antimony or its Regulus, because the Acids, with which the Sublimate is made, are stronglier attracted by the fixed Salts and the Sulphur in the Antimony, than by the Quicksilver; the Quicksilver being therefore freed, as we may say, from its Bonds and Fetters, returns, that is, attracts itself again. Where-ever Acids have disguised Mercury, it may be reduc'd and reviv'd, by putting Lime to the Metal, and distilling into Water, and the Mercury comes over in its former Shape. And Sublimate added to Antimony by Distillation, we recover partly Cinnabar, partly Butter of Antimony, and partly also Quicksilver; the Butter is the reguline and sulphureous Part of the Antimony join'd to the acid Salts. The *Cinnabar* is Quicksilver, Sulphur of Antimony, and acid Spirits, as readily appears by its *Analysis*; for if we powder it and mix it with Salt of Tartar, and distil it in a Retort, the Mercury mounts and runs into the Receiver half full of Water, and the Sulphur stays in the Retort; the Butter is the reguline and sulphureous Part of the Antimony, as has been said: If we reduce Quicksilver by Steel, and make it mount, there are afforded *mercurial Flowers*, which are nothing but Steel and Acids join'd together, and will run *per Deliquium*, and becomes that Preparation commonly called *Olium martis*, which is made in the following manner; Take the Caput mortuum of volatile Sal Armoniac, which was made with Salt of Tartar, one Ounce, Filings of Iron or Steel two Ounces, mix them well together, and expose them to the Air in a Cellar for four or five Days, for then the Air by its Moisture dissolves the Salts; and then the Steel is attracted by the dissolved Salts; then put them into a Crucible, and calcine them for

the Space of three or four Hours in a strong Fire, until all the Fumes are gone, and the Ingredients become red hot ; let them cool, and beat them to powder, put this Powder into a *Manica Hippocratis*, hang it in a moist Cellar, having a Glass to receive what drops down : Hence it is better made in rainy than dry Weather ; when it has done dropping, take the Glass away and keep it for Use ; it is a yellow Liquor : It is an extraordinary Styptick, and is good in all kinds of Fluxes, whether of Humours or Blood ; hence it is excellent in the Whites, or in an excessive Flux of the Menses or Lochia, and for simple Gonorrhœas, or at the End of a virulent one, when the Matter turns ropy ; though of any green or yellow Colour, nothing exceeds it ; it is given in any Decoction to fifteen or twenty Drops, and is taken Morning and Evening. The Steel plainly appears in it, because if it is poured into a Decoction of Galls or Oak Leaves, or of Pomegranate Peel, or of Balaustius, or into an Infusion of Tea of either Sort, it turns the Liquors as black as Ink, and is again, like Steel Liquors, clear'd up again by any Acid whatever, putting enough in : These two, I say, seem to be different Methods of preparing the same Medicine, for in either the Acids prey upon the Steel, and turn it into a Vitriol, which is, as usual, precipitated into a black Powder by any of the usual Methods, and is made clear again by more Acids added.

71. As for fix'd Salts, they are the less volatile, and more fix'd and earthy Parts of Bodies, which, without Additaments, will remain in the Crucible, and will even, by a very strong Fire, run into Glass ; they are more heavy specifically than volatile Salts, that is, they contain more Earth, and detain all Volatiles in them, as in Cafes ; they are had by Calcination generally speaking, and such as are con-

contained in Animal Bodies are not truly fix'd Salts, but may be call'd *Alcalisate*. Fix'd Salts are mostly Earth, because if you lixiviate Salt of Tar-tar in Water, and filter it, you will find a great deal of Earth in the Filtre ; evaporate the Water, calcine the remaining Salt again, lixiviate and filter again, you find more Earth upon the Paper again : Thus by repeating this Experiment ever so often, we still find Earth upon the filtering Paper, which shews the reason why they vitrify by a strong Fire, because they are fine Earth ; and this moreover convinces us, that fix'd Salts will fly off by a strong and durable Fire, and leave the Earth behind as a *Caput mortuum*.

72. There is no doubt but these Salts are convertible into volatile ones, but then we cannot say there is any Mutation of Principles, only a certain Degree of Division is made, by which they become Volatile, that is, those volatile Parts which lodg'd in their thick Cafes are extricated, or these Cells are divided into so minute Parts, as to let out the Steams ; certain it is, whatever Reasoning we may produce for this Phœnomenon, that fix'd Salts do become Volatile by an Addition of Pipe Clay, and a strong Fire, as has been already said.

73. There is a certain Modification of Principles to reduce Salts to be volatile or fix'd ; these two differ in their Gravity, Minuteness, Figure and Motion, Volatiles being smaller, more moveable, more pointed, and lighter Bulk for Bulk than fix'd ones ; and to compound the one and the other, a determinate Quantity of Principles are requisite to each, though easy to distinguish between them, when done by Art.

74. These fix'd Salts are made out of Plants and Vegetables principally, by burning them to Ashes, which is term'd Incineration ; then by putting warm Water upon them, or by boiling them

in Water, which is call'd *Lixiviation*; then by filtering them, call'd *Filtration*; and lastly, by evaporating the Water, call'd *Evaporation*, you gain the *fix'd Salt*, which you whiten by a further Calcination.

75. All Woods and Plants whatever afford fix'd Salts, however, those Woods and Plants that are bitter, so they be fresh, afford the most; for when they become dry, they afford little or none.

It is very evident that fix'd Salts differ from each other in their Degrees of Strength, so that some of them are caustick, whilst others are mild; we can give, for Example, twice as much of any other fix'd Salt, as of Salt of Tartar inwardly, and yet we dare not venture to administer the Salt of Ash by the Mouth; it is therefore a little surprizing to find some affirm, that there is no Difference in the fix'd Salts of Plants, at least an indiscernible one, when what I have observ'd to you is known to all Chymists whatever.

* Fix'd Salts have an Acid in

* P. 113. *Wedel.* their Composition, and therefore will they make Steel into a Crocus, because the Acid preys upon the Metal, and turns it into a red Powder, and the Sulphur in the Metal is exalted and mixes with the watry *Menstruum*, and so leaves us the Crocus pure; the same happens more eminently in Salt Armoniack, when it converts Iron into a Crocus, which having more of the Acid, licks up more of the Steel, and gives it a larger Surface: So that the Acid join'd to the Iron, is exalted by Sublimation along with the volatile Salt, and all together make a Vitriolick and Volatile united into an *Ens Veneris*, but Water takes off both Salts, and leaves a fine and elegant *Crocus Martis aperiens*. The Difference between the *Crocus Martis aperiens*, and *astringens*, is this, that the first has more of the Steel,

Steel, and the latter much of the concentrated Acid join'd to the Steel ; so that the first acts primarily and principally by its Weight, although there is so much Stypticity in it, as to constringe the Fibres, and to give them Strength and corroborate them ; but in the latter there is so much of the concentrated Acid, that their primary Effect is a strong constrictive Power, and their secondary an aperitive Power : Hence is the *Crocus martis astringens* a safe Astringent where Fluxes are so to be suppressed, as to leave the Vessels sufficiently flexible for Nature's Discharges. That I may be better understood, it will be necessary to fix upon a Case which demands this Caution, if therefore, for Example, a Woman labours under an immoderate Flux of her Menses, the Physician's last Intention is to curb them in such a manner as to leave room for their appearing again at a proper Period of Time ; now if the Astringent made choice of be of such an emplastick or constringing Faculty, as intirely to bung up the Passages or Glands, then they will never appear more again, which would be greatly detrimental and dangerous ; but if it so curbs the Flux, as to leave room enough for re-opening at a proper Period, we gain our Point : This *Crocus martis astringens* performs.

After all, the Moderns do better in making use of acid Spirits to make Crocus's withal, 'tis as well a shorter Method, and the same Effects are produc'd by them.

Some calcin'd Bodies have a corrosive Acidity join'd to them, as Alum, which being calcin'd to a dry Crust is an Escharotick, but if we calcine it in an iron Vessel, it becomes gentle, and not corrosive.

76. As to their Uses in general, they serve both for mechanical and physical Service ; Glass-makers use them in fine Powder unmade or unprepared,

and the heavy part sticks to the common Sea-Salt that is on the Surface of the Sand, whilst the woody Ashes, or *Terra-damnata*, mount above the Glass, and indeed, both the Ashes and Salt swim at last above the Glass, and is scumm'd off, and is call'd *Sandevers*. They are in high Esteem among *Workers in Metals*, because they flux them, or make them run sooner into a Mass of liquid Matter. Dyers precipitate their Vitriols with them, and according to the Metal that is precipitated, the Colour is struck, which Experience has taught them: we see, for Example, that *Lac Virginale* is white; Copper is blue; Sugar of Lead, with sympathetick Ink, is black; Sublimate is red with fix'd Salts, yellow with Oil of Tartar.

As for the physical Use of them, they are aperient, dissolve Coagulations, are Anti-anasarcous, Anti-intermittent, Anti-acid, Anti-cardialgick, and Anti-emetic.

77. We shall in the next Place take into Consideration, the Nature and making of a *Regulus*; A *Regulus* is a Separation of the finer and nobler, as well as heaviest Parts from the *Scoriae* or Scum: This *Scum* appears to be a grosser Sulphur thrown off from the metallick or mineral Body, and as it is specifically lighter, it mounts to the Top; but the Method by which this Scum is thrown up, is by a fusing or smelting Fire; thus do Metallists turn their Copper with Antimony, Arsenick, or Sulphur; so do Chymists treat Antimony with a strong Fire: it has intrinsically Sulphur and a mineral Substance; the Sulphur flies up by the Force of the Fire to the Top of the Crucible, and leaves the Regulus at the Bottom. That this is the genuine Cause of this Separation, appears by this Circumstance, that we can convert the Regulus of Antimony back again into Antimony, only by adding Sulphur to the powder'd Regulus, and

and mixing them exactly together, as we do when we make *Aethiops mineralis* out of Quicksilver and Sulphur: we more readily gain the Regulus, if we mix a little fix'd Salt along with the Antimony, but then this Addition of an alcaline Salt converts the *Regulus* into Glass, particularly if the Antimony run long together; for as Earths are convertible into Glass by detaining them so long upon a strong Fire till all extraneous Parts are exhal'd; so according to the Nature of the Volatility of the Particles, some require a longer Detention than others: But Antimony the least of any, its Sulphurs being easily let loose for flying off by a little fix'd Salt, and then the pure Earth, that is, the Glass is only left.

78. It is evident therefore, that *Reguli* are only metallick or mineral Parts freed by Additaments and Fire from all fugitive or volatile Parts, they are only pure Earths, as far as we can rid them of all their exotick Parts; for in Antimony it is plain by Infusion of the *Regulus*, and even of the Glass itself, that there is something that still adheres so closely to the Body, as to become Emetick in a high Degree; altho' some fuse the Glass without any Salt, and doubtless it will be more Emetick thereby, however it is hardly possibly to rob it so intirely as not to prove nauseous; for if we powder this Glass, and digest it with Oil of Vitriol, and then edulcorate with Spirit of Wine, yet still it proves Cathartick; if we detonate with Nitre, it becomes Diaphoretick, yet still it proves nauseous; wherefore Art has hardly yet found out any Method whereby to rob Antimony of its Sulphur, only Affusion and Re-affusion of Wine does at last exhaust it.

79. We have not as yet been able to rob the Regulus of Arsenick of its corrosive Quality; it is calcin'd with Salt of Tartar for that End, but in

vain : It is not always in our Power to separate Parts, our Fire is limited, as appears by the Sun being capable of vitrifying with Glasses, what could not be effected by our Furnaces. If we rely upon Experience, how comes it to pass, that *Arsenick* should be render'd more caustick by Salt of Tartar, and yet that Salt of Tartar should be a Counterpoison against *Arsenick*? I only start this Paradox at present, and leave the Solution of this Problem to be given by such as have applied to the Study of the *Materia Medica*; I shall only give one Hint towards its Solution: *Arsenick* and *Antimony* are mix'd Bodies, they are metallick and sulphureous; Acids adhere to both, so that they acuate the Earth and Sulphur too: Hence, if we aim at gaining the Earth, and making it innocent, the Acid sticks to it; if we hope to get the Sulphur innocent, the Acid sticks to it also, and makes it corrosive; when therefore we calcine Arsenic with Salt of Tartar, it becomes more corrosive, and, in the manner of Lime, is corrosive from an intimate Cohesion of Acids, fix'd Salts and Earths, as appears by the grey Eschars they make; and as in the antimonial Regulus, only repeated Infusions take off its emetick Property, so, perhaps, in *Arsenick* the same may be done.

Of Digestion, Maceration, Fermentation, Extracts.

What is meant by Digestion is a moderate Warmth; for when we have a mind to unite the Particles of Bodies together, we put two or more Ingredients together in a proper Vessel, and by standing in a gentle Warmth, they gradually unite and become a Tincture.

Digestion must be made by the most moderate Heat, because the Bodies are to be join'd together without acquiring any *Empyreuma*, or without being

being burnt ; and the gentle Motion of the Fire lifts up the heaviest Ingredient gradually into the Pores of the Liquor, and causes it to penetrate them, so that when Tinctures are made, those which are the longest digested, retain their Colour and Virtues best, so that it should seem, as if by giving too violent Fire, we broke the Texture of the *Menstruum*, and that it does not keep the Body so well suspended, so that there seems to be some Foundation for taking a longer Time to digest Bodies than is usually done ; however, it is certain, that the longer we digest, the stronger will the Tinctures be.

Digestion is therefore intended for the Union of Particles, Acid as a *Menstruum* is a chymical Fire, so is Digestion an actual Fire ; Dr. Freind makes a Discourse how Bodies lighter, heavier, and equally heavy can be made to unite together, and he says, that Bodies of equal Gravity should unite is not strange ; that heavier Bodies should be suspended, he computes, that as Surfaces increase by Division into minuter Parts, the Resistance also increases in the same Proportion, therefore the Liquor resists the small Bodies weight, and becomes an *Æquilibrium* for them, and they are suspended ; but when he comes to account why lighter Bodies don't emerge, he becomes unintelligible ; one true Reason of which must be the Cohesion of the Dissolvent, for assoon as you destroy that Cohesion by any Artifice, the lighter Body emerges in an Instant ; lighter Bodies have also large Surfaces, and little Matter, so that so gentle an Agent as a digesting Fire, gives these Particles a very small Quantity of Motion, and the Dissolvent will be carried furthest up by it, therefore upon both Accounts they may be made to swim.

It is chiefly intended for the Conjunction of homogeneous Particles, although heterogeneous Parts are also by means of Salt of Tartar united together.

To the end Digestion may go on more prosperously, it is convenient to divide the Body to be digested into very minute Parts, especially if they be hard Bodies, for then they require less Fire, and less Time to be digested.

Without Fire Digestion does not go forward, Fire is an universal Agent to move and dissolve Bodies.

By Digestion we change the Energy and Force of some Bodies, so that it ought to be well consider'd what we are to expect by Digestion; for Example, *Mercurius Vitæ* is a very strong Emetick deserving an ill Name, yet if we digest this with Spirit of Wine, it becomes more mild; but Gums dissoluble in Spirit of Wine have their Virtues more increased by Digestion; because their whole Parts are communicated to the Liquor which is very penetrating.

Digestion is a Species of Boiling, and may be reputed a Demi-coction, and therefore what may be done by Coction, may be done by Digestion.

The Force of Digestion appears in the rubbing of an Apple, where an acerb Taste is by this Pressure and Friction chang'd into a Sweet, and a Sweet by Motion into a Bitter, as it happens in Pears when they become too ripe, they taste bitter like *Coloquintida*, and it is thus that in human Bodies our Humours are prepared by Digestion; that is, by Warmth and Motion, and as Plants have Juices put in Motion by the Air's Pressure and the Sun's Warmth, so do both Animals and Plants give out by bare Digestion fix'd and volatile Salts; nay, we see how, by digesting (Motion and

and Air) Oil of Turpentine and Salt of Tartar into a dry Substance, a volatile Salt can be had from it.

By Digestion the Colour is changed, and very often the Taste also, as well as the Smell, and therefore Bodies digested that undergo all these Changes must suffer some Alteration in their component Parts, and must consequently acquire new Virtues different from what the original Drug enjoys, and by the same Way of Reasoning, those which retain all, retain the same Virtues they had in the whole: Thus they who affect to use the resinous Part of the Bark, make use of rectified Spirit of Wine for a Dissolvent; they who would have both the resinous and saline Parts make use of Wine; now it cannot be supposed that these two Tinctures can act univocally, or in one and the same Manner; for Resins and Salts have very different Effects.

Mineral or Metallick Medicines prepared by Digestion are mostly liquid Vitriols, but animal and vegetable Tinctures are either saline or sulphureous, because mineral and metallick Bodies are dissolved in acid Spirits, and the others in Wine, Water, or Spirit of Wine.

Maceration is also a Species of Digestion, where by a gentle Warmth of the Liquor pour'd upon dry Bodies, and by the Pressure of the Air, the Liquor penetrates into the hard Substances of Drugs or Woods, and is a Preparative for Coction or Fermentation.

Fermentation is a chymical Process, by which the spirituous Part contain'd in Liquor is made to appear, and the necessary Conditions to produce this Effect are grinding the Bodies into minute Parts, and putting them into Motion.

If there were no heterogeneous Parts, there would be no such Separation made of Spirit,
as

as we see in fermented Liquors; these Parts are put into Motion with letting them loose by dissolving them: The Agents then are these heterogeneous Parts, and the Separation is an Effect of these Parts put into Motion. As soon as the Parts are prepared and diluted, they begin to work upon each other, this appears in many Instances, for Bran put into Water will of itself grow hot in a few Days, so as not to be touch'd.

By Fermentation, according to the modern Acceptation of the Word, we obtain vinous Liquors and Vinegars; but if under it we were to range Putrefaction, then we would get also urinous ones.

That Fermentation depends upon an Heterogeneity and Diffimilitude of Parts, appears by this, that whenever the acid Parts are too few with respect to the oily ones, no Fermentation ensues, or if the oily ones are too numerous for the acid ones, this Process does not succeed; there must then be an exact Proportion to succeed, so much Truth is there in this Assertion, that if Ale be working, throw in any resinous Drug, it will put a Check to its working, or if to Paste that is working you put a little Oil, it presently ceases, as if to Coral fermenting, you add a little Oil, it ceases to huff: It is not the Oil that hinders these Motions as Oils, but as exceeding the due Proportion that is required: For altho' these are found by daily Experience to be the constituent Parts for Fermentation, yet there is a Geometrical Nicety in adjusting the Quantity of each; *Tachenius* says, more than One eight hundredth Part of an Acid extinguishes Fermentation, and in Fact, it is well known how small a Quantity of Leaven is required to sour the whole Mass.

The first time a Body is fermented, it affords Brandy Spirits, and not before. The next time, it affords Vinegars. Vinegars may be distill'd into an acid Spirit; and if we leave the Dregs to ferment, after Brandy is drawn off, we obtain a volatile Salt and Spirit; but this last sort of Fermentation is call'd Putrefaction, which is a perfect Solution of the Body, whereas Fermentation is but a beginning one.

There are certain Conditions found necessary, by daily Experience, to Fermentation, namely, the *Air must be admitted*; for this is the universal Agent, that presses the fermenting Particles together, without Air nothing either ferments nor putrifies, of itself it communicates Particles capable of fermenting with the oleous ones in the Body, so far that when these abound too much in Winter they stop the fermenting of Liquors, and we are obliged to use a moderate Heat to keep the Liquor from freezing; hence *Warmth* is another Requisite, for unless the Parts of the Liquor or Mats be kept open, and it be of a due Consistence, there will be too great a Resistance, and the Ferment cannot penetrate; but if Warmth be apply'd to Milk, altho' you put Juice of Lemon to it, you shall not coagulate it, for Motion hinders Coagulation, and therefore Cold stopping Motion, hinders the Fermentation: *Moisture* is also necessary for Fermentation, because without it the Parts cohere too much together, and the heterogeneous Particles can't move towards each other without a free *Medium*, and yet great Care must be taken that the Liquor should not exceed certain Limits, for then these struggling Particles are placed at too great Distance from each other, so that their Attraction is destroy'd, and no Fermentation ensues without an Evaporation. Another

ther Condition is, that the Body to be fermented must be cut or bruised *moderately small*, because a compact Body cannot be readily dissolved nor penetrated into by the Liquor, and nothing too hard can ferment, because to Fermentation there is required an Access and Recess of attracting Particles; but if the Body is in large Bulks, the Liquor never extracts those moving Particles, and therefore they must for ever be at Rest, whereas when they are moderately small, every moving Part is surrounded and touches the Liquor, and is extracted, and then begins Motion, because there is a Solution of the active Bodies, namely, the Oils and Acids are let loose into the Liquor: There is also required *Space* for Fermentation; for we see how Liquor that works so dilates, that it breaks the narrow Vessels containing the Liquor; for Example, both Bottles and Casks are broke by its Force, and do we not see how dangerous it is for Trees to grow at the Bottoms of Bridges, that such a Force as Digestion increases the Tree in despight of the Bridge's Weight, and even saps it at last? Lastly, some *Ferment* is required to bring on a working, if it be not intrinsically in the Body itself; so to all other Liquors save Wine, we add Barm or somewhat equivalent, to cause it to ferment: It is a Question I have often thought worth Inquiry, how we first found out Barm, and why the same may not now be found again; but the Answer is easy, for Stum is the Froth of Wine, that will ferment Wine afresh, and this added to Ale will produce Barm; and I don't know whether Stum would not make our Ale much more agreeable than Barm.

The Effects of Fermentation are, to render Liquors vinous, and whereas before they would not inebriate nor afford Brandies, they

now heat us, excite airy Thoughts, or, however, various ungovernable Passions, for which we often merit the Name of *voluntary Devils*, and receive condign Punishment for our vile Actions caused by such Liquors too plentifully glutted down.

I shall here subjoin the Difference between Fermentation and Putrefaction.

Fermentation gives out ardent or vinous Spirits, acid Spirits, fix'd Salts, Oil, and Earth.

Putrefaction gives ætherial, volatile, and fetid Oils, volatile Spirits, and Salts; it obtains in Animals, and volatile Plants; it requires Humidity: A *Fætor* distinguishes putrefied from fermented Bodies: It is prevented by Acids, or an Evaporation of all Humidity; for Salts don't act without Moisture; we obtain a volatile Spirit from the Dregs that remain after the Distillation of vinous Spirits, if they are left to putrefy.

Putrefaction therefore seems to be a perfect Solution of Bodies, whilst Fermentation is only a Beginning of a Solution, or an imperfect Separation; in Putrefaction the Parts are more mov'd and rubb'd than in Fermentation, because the Acids, Earth and fix'd Salts become volatile; but in Fermentation they are all got apart: in Putrefaction the Oils are less mov'd indeed, because by further Distillation they become Spirits, as they do by mixing them with acid Spirits and redistilling; for Spirit of Salt or Oil of Vitriol redistill'd with Brandy Spirits, turns them into Oils: But the Salts are more mov'd, because all the fix'd Salts become volatile.

So that according to the Degree of Motion between various Matter, Bodies afford ardent Spirits and fix'd Salts, or volatile Oils and Spirits and Salts.

Here

Here might follow various vinous Liquors.

Extracts are of two Sorts, namely, they are liquid or solid; liquid Extracts are Tinctures, and solid ones are the Liquor exhaled into a gummose Substance; the liquid Extracts are generally made by fix'd Nitre or Salt of Tartar, or by any fix'd Salt, into Tinctures, or Essences: The Antients call'd Tinctures Solutions of Metals; but we hardly now adays call any thing such, but what we make from Vegetables.

What was said heretofore of *Menstrua* may here be call'd to mind, to wit, that whatever dissolves a Body extracts its Virtues, and communicates them to the *Menstruum*, and the various Species of Particles determine the Variety of Menstrua; so that Water is made use of for extracting the Tincture out of some few Vegetables, as in Violets, Clove-julyflowers, and some others, in order to make Syrups; that Spirit of Wine is used for many Tinctures to be had from Aromaticks, Fetids, Bitters, and the like; thus do we get Tinctures of Castor, of Saffron, of Amber, of Jesuits Bark, of Benjamin, of Cinnamon, of Nutmegs, and of many others; that from sharp Juices and Vinegar we gain Tinctures of Steel, of Antimony, of Copper, and others; that by oily Menstruum we extract sulphureous Tinctures, for Like attracts its Like; so we can take the Red from Coral by white Wax melted; so we get all Balsams of Sulphur; that by spirituofo-alcaline Menstrua, we gain both vegetable and metallick Tinctures, such are Tinctures of Steel, of Silver, and many others, such as Opium, Castor, Myrrh, and others.

Quintessences are the strongest of Tinctures; for Example, when we have digested any Body in a proper Menstruum, and have thereby obtain'd

obtain'd its Colour, if we evaporate the Menstruum a little, or, which is better, if we add more of the Ingredient that gives the Colour, so as to make the Menstruum full of the Ingredient, this may be call'd the Quintessence of that Ingredient.

Solid Extracts are prepared from Juices of Plants decocted and evaporated to the Consistence of Honey or to a Solid, but not a dry Mass, according to the Inclination of the Prescriber; thus is made Extractum Rudii, Extractum Thebaicum, and many others. See *Pharm. Lond. p. m. 36. Edit. in 12^o.* It is, however, to be noted, that no Volatiles ought to be made Extracts of, because all their volatile Parts fly off into the Air.

To Extracts may be referr'd Balsams, which are generally of a soft Consistence, made up of thick and thin oily Substances conjoin'd; for Example, of Oils by Expression three Parts, and of distill'd Oils one Part; their Consistence is so solid as not to ferment, and yet so soft as to be supple, they therefore keep for a long Time together.

Some affect to give them a Colour, and this is done with Syrup of Buckthorn, if we would give them a green Colour; if a red, with Cochineal; if a black, with burnt Ivory; if a blue, with Lapis Lazuli or Indico.

Their Uses are chiefly vulnerary, because they consist of Particles that are volatile and oily, which are diametrically opposite to the corroding Acrimony in Ulcers.

Mucilages are a sort of Extract also, which are got by boiling Plants of a mucous Nature in Water, and expressing them, or to allay Gums in Water to a due Consistence; thus Comfrey Roots, Seeds of Quinces, Gums Tragacanth,

and Arabick are in use for these Purposes ; but Animals may also be boil'd down to a Jelly, as all know, so as at last to make a solid Substance for Soop ; this is done out of Flesh, Horns, or Fish.

The Intention of giving such Mucilages is to temper all acrimonious and corroding Humours, to agglutinate and heal all internal Ulcers, in Consumptions, in Thrushes, in Bloody Fluxes, in Fissures, and such like.

R E S T.

Cryſtallisation of Salt Water robs the Water of its Salt.

Cryſtals concrete as soon as Liquors grow cold, but are diſſociated by Heat.

Gentle Acids hinder Motion and Fermentation. Cold proceeds from Rest, or want of Motion in Bodies.

The Soul not acting may be compar'd to Rest. Retardation is a Species of Rest, which proceeds from Obſtacles and Friction.

Rest proceeds often from Gravity, which resists Motion.

Cold helps the Coagulation and Condensation of Vapours.

A Privation of Motion in human Fluids and Solids introduces an Infenſibility.

The Cause of Rest in Motion in Projectiles is from Gravity and Reſistance or Friction.

Fluids lose of their Motion, as they lose of their fluid Consistency.

Bodies are retarded by their Surface, and resist by their Quantity of Matter.

O R D E R.

O R D E R.

The Order of Bodies, that are homogeneous, cannot be changed by melting, for they return to their pristine Form as soon as they cool.

The Order of Glass being changed from a connected to a disunited and powder'd Body, causes Diaphaneity to be changed into an Opacity.

From the Order of Particles in Bodies arise the primary and secondary Virtues of Medicines; thus happens it that Rhubarb first purges and then astringes; and many others being compounded of various Parts, have contrary Virtues, to wit, they exert one Virtue in an Instant, and its contrary some Hours after.

Thus it happens that the Stroke of a Hammer so disranges the Particles of a Magnet, that it changes its Pole.

Thus also comes it to pass, that hammering of Silver makes it elastick.

S I T U A T I O N.

Situation and Position have a great Force on Bodies; it is surprizing that Iron standing in a perpendicular Posture should acquire a magnetical Power; what Pangs do not Persons troubled with the Stone feel, when it lies across in the *Pelvis* or the Neck of the Bladder? Posture does often cause, and at other Times relieve Torments.

D I S T A N C E.

Distance has a great Share in many Effects; for when Particles are placed at such a Distance as to be out of the Sphere of Attraction, no

Effects are produced ; but if they be near a Contact, great and visible Effects ensue ; v. g.

Glass is made by an agglomerated Contact of homogeneal Earth, which concretes by Fusion, the Salts come up to the Top, and the Earth unites at Bottom.

Cohesion is destroy'd by terreous Powders amongst Salts ; for they intervene ; and from hence Fusion is easily prevented with a small Fire.

Contact is the Cause of more easy or difficult Calcination ; for a less Contact causes an easy Fusion, and a greater, a greater Difficulty.

A hard Body is more readily fused, by mixing a Body easily fusible with another harder to fuse, as Silver with Lead, Regulus of Antimony with Tin and Copper and Silver ; so that, as is said, a Body easily fusible depends upon fewer Contacts, and a Body hard to melt depends on many Contacts.

Brittleness depends on small Contacts and short Parts ; Luna Cornea is made brittle by Mercury Sublimate, when melted together.

Bodies under Contact act more strongly, and readily coalesce.

Cohesion hinders Ascent ; hence viscous Bodies are not readily distill'd.

Bodies that run, melt, or are link'd together, are not fit for Distillation, unless by somewhat that will separate their Particles ; thus Salt-petre is not distill'd unless you mix it with Bole Armeniac or some Earth ; so burnt Alum is distill'd by Salt of Tartar.

The nearer is Fire, the more intense is it ; that is, inversly as the Square of the Distance.

Salts placed under Contact do crystallise, otherwise they do not ; and hence appears the Reason, why Heat, which dissipates and sets the Salts at Distance from each other, hinders Crystallisation ; and.

and by a contrary Reason, why Cold makes them coalesce and crystallise.

Attraction of Cohesion is lessen'd by Distance, and increases as Bodies approach nearer to Contact.

The Sun warms us according to his Distance, that is, inversely as the Square of its Distance; for the less is its Distance, the warmer is it, and *vice versa*, the greater it is, the colder it is; if it be five times nearer us, it is twenty five times warmer, *cæteris paribus*.

Particles which are of a moving Nature, placed at too great Distance from each other, cannot putrefy, effervesce, ferment, or act; for there is a certain Distance, that Particles will not attract at.

TEXTURE.

What we understand by Texture will be comprehended by its Definition; it is, strictly speaking, an Assemblage of mechanical Properties constituting any Body, or *a certain Disposition of the constituent Parts of any Body*; by this Bodies become of such a Nature, they have such Effects, and appear under such Forms: Texture is completely divided into two Forms, to wit, into a *Characteristick* or *Differential Form*, and into a *Principal* or *Essential* one.

That Form is characteristick, which distinguishes one Body from another of different Species; for Example, Gold is yellow, ductile, heavier than any Species of Body we yet know, unites with Quicksilver, is dissolved only in Aqua Regia, or strong Spirit of Salt, less elastick than other Metals, &c. and that Form is *principal*, where Bodies contain Principles or the *Principiata* in them, by which they operate on human Bodies;

these *elemental* Bodies operate by their peculiar Texture, or by an Assemblage of mechanical Properties, with which they are vested and cloathed in a stated Manner : Water, for Example, when it is homogeneal is always flexible, fugitive, incoherent, humects, relaxes when warm, corrugates if cold, dissolves Salts, &c.

Texture therefore is an ambiguous Expression, and denotes either the Marks of Distinction of one Body or Species from another, or the *Principles* by which Bodies act upon each other.

Wherefore to account for Effects, we must consult the Texture of Bodies, that is, we must know what *mechanical Properties* concur in any Body to produce certain Effects.

I shall exemplify this in several Instances : Suppose, that

Homogeneal Bodies never change their Order of Particles, and therefore whenever they are fused or melted, they always return to their pristine Form ; thus Gold or Silver melted ever so often do not change their Form, but do still melt into Gold and Silver again.

Rectification is assisted by Absorption of acid, aqueous, mucous, and oily Parts, with Alcalines, Spirit of Wine tartarised, Pot-ashes, Lime, Paper, and saline Bodies ; for these attract the former, and retain them, so that nothing mounts but the fugitive Particles.

Precipitation readily happens when the Gravity is increased and the Cohesion is lessened ; that is, when the Texture of the Body is alter'd.

Tastes arise from *Figure* and *Motion*, because when we taste Bodies, we only apply them to the Organ of Taste ; the Alteration depends

pends then on the Bodies we apply, whose Texture must differ therefore according to the infinite Variety of Tastes impreis'd; which Variety of Texture we learn by analysing Bodies, and mixing them with one another; by *Analysis* we gain the simple elemental Corpuscles which compose all Bodies, and which, when they are homogeneal, are vested with a constant Number of mechanical Properties, which are always the same; and therefore when we say that such a Body contains such a Principle, we know that it will for that Reason act in such a Manner univocally and unchangeably; for Example, Water always acts in such and such a Manner, or volatile Salts have always such a Set of mechanical Properties, by which they act in such and such a Manner: These Principles are the immediate Causes of Impressions, but the mechanical Properties are the antecedent or first Causes of them; because Principles don't act, but as they are Corpuscles endued with such Figures and Motions and other Affections primary or secondary of Matter; so that these *mechanical Affections*, and these *chymical Principles*, are the *σύκεια σύκειων* which *Lucretius* speaks of: The latter are such Principles as all Bodies are proved to consist of, and the former are the Principles by which the latter act upon human Bodies and upon each other.

It is easy to prove, that all Bodies are ultimately resolved into the chymical Principles, or into certain Classes of Elements; and *Aristotle* has inform'd us, that Bodies do necessarily consist of such Parts as they can be ultimately resolved into; these Principles therefore are the compo-

nent and constituent Parts of all Bodies whatever ; they are divided into four Classes, which do always retain the same Shape and Form ; so that whatever Body changes into another is not a Principle ; thus Quicksilver is always Quicksilver, and Gold is always Gold, and when Spirit of Wine is highly rectified it cannot be changed into any thing but itself ; thus Oil is never changed into Acid, nor Water into Earth, nor Earth into Oil nor Water ; if this happens, we cannot repute the Principle to be homogeneal.

This brings us to consider the Purity of a chymical Principle ; for Mr. Boyle has declared, That Oil distill'd with Quick-lime affords Water, that Water distill'd does always afford Earth ; and that sixteen Ounces afford only one Ounce of pure Oil ; that a Pound of Oil of Aniseeds affords four Ounces of Earth, and but one Ounce of pure Oil, or, as some, two Ounces ; that Oil of Turpentine goes all into Earth ; that Spirit of Wine is Oil, Acid, and Water strictly united, and hard to be separated ; that Spirit of Guaacum, which is Acid, by standing deposites an Oil ; that Vinegar affords Water, Oil, an alkaline Salt, and an acid Spirit.

Also from Mr. Homberg we know,

That 3x*fl.* and gr. vj. of Spirit of Nitre contain but 3ij*j.* gr. x. of acid Spirit.

That 3ij. 3v. of Spirit of Salt contain only 3ij. of Spirit.

That 3j. 3ij*fl.* of Aquafortis contain only 3ij*fl.* gr. vj. of strong Spirit.

That 3ij. 3v. of Aqua Regia contain only 3vj. of strong acid Spirit.

That 3v. of Oil of Vitriol contain only 3ij. gr. v. of Spirit.

That

That Spirit of Vinegar 3j. contains only gr. xvij. of Acid.

That Vinegar 3j. 3ij. contains only gr. xvij. of Acid.

But from *Homberg's* Experiments it evidently appears that Mr. *Boyle's* Objections against chymical Principles are not fairly stated; for whereas Mr. *Boyle* gathers up a large number of Trials to shew the World that what are reputed chymical Principles are really greatly compounded Bodies; Mr. *Homberg* shews us, that such Bodies may be brought to a greater Homogeneity and Purity, so as to merit that Name *quam proxime* by *Concentration*; what Mr. *Boyle* says is true; but all that can be said is, that the Bodies he reputes as Principles are not such, nor are they acknowledged now as such, whatever they might have been in his Time; for till nothing remains but what is of one *Species*, it is not esteem'd a chymical Principle; and it is a Question whether we can so divest any Principle of other Adjuncts as to be merely a Principle; for all our Endeavours have not been able to separate the Oil of Mustard-seed from its volatile Salt, but that some of it adheres to the Salt; Sulphur adheres so to Antimony, that rob it of it with all the Care and Nicety you please, still you may draw a Tincture from it by Spirit of Wine, and the more of this Sulphur it contains, that is, of Oil and Acid, the more it vomits; Mercury does certainly contain some Sulphur and Acid, which it is hard to rob it of, altho' it may by Chalk, Steel, Salt of Tartar, and Spirit of Wine, and such like, be made much heavier specifically; Spirit of Wine rectified for twenty times together, will still make Salt of Tartar a *Tartarus Vitriolatus* upon Distillation; Spa Water has not been so nicely handled

handled as yet, as to disclose what makes it taste winy ; altho' we are sure it contains some Oil of Vitriol by other Trials. Neither Distillation therefore nor Concentration can procure us pure Principles, but it is sufficient to us, that we can approach nearly to them ; and as *Denominatio sumitur à potiori semper*, that is, that is the Principal which predominates ; wherefore when Bodies are divested so much of their *Adjuncts* as to contain a very inconsiderable Part of another Principle, it ought to be reputed a Principle, which is all we contend for.

The Want of sufficient Experiments to convince us of the Individualities or particular Adjuncts of some Bodies, has made us rely so much on Experience ; for, as it will appear in the next Part, *Principles do always act univocally* ; but if there should be any *Adjunct* which Experiments have not convinced us of, and yet Experience confirms us that it has such, we must not resist it nor obstinately stand out against this Experience, but admit it, till further Experiments discover the Presence of such an *Adjunct* ; for Example, *Spa Water* does not coagulate Milk, which it ought to do, if it only contain'd a Vitriol ; however, it has since been found to contain a Salt of Marle or a volatile Salt, because it precipitates Mercury Sublimate into a white ; we know that Salt of Tartar blended with Spirit of Vinegar huffs, but then they grow cold together, so as to settle the Thermometer ; whereas if you mix the Salt of Pot-ashes with this Spirit, they grow hot : Now as yet nothing has appear'd to discover to us the Reason of this Individuality ; however, we cannot deny the Evidence of our Senses, when we speak of the common Course of Nature : Specifick Virtues depend very often on these *Adjuncts*, which are unknown to us from

from any other Method than Experience ; this is evident that these individual Qualities do proceed from somewhat unknown to us ; and in Truth, many Medicines of the same Class and Nature, as to their known Effects, do contain somewhat unknown to us, by which they become more eligible for certain Diseases, than others of that Species, and so it fares with the Peruvian Bark ; so fares it also with Spirit of Vinegar, which does not coagulate unless it be brought to a pure acid Spirit : Thus it is with very many Medicines ; but then I must observe, that this depends upon the Indolence of such as make use of them ; for Attractions we shall never come nearer, it is sufficient we know them by Experience.

This Observation answers a frivolous Objection against Individualities, to wit, A Principle appears by what it is, and not by what it becomes by any chymical Operation ; therefore Hartshorn containing an alcaline Salt, does not act as an Alcali : So in Vinegar, the fix'd Salt it contains does produce no Effects.

But this is easily confuted, for why does neither Vinegar or its Spirit coagulate the Blood, but because it is a neutral Salt from its fix'd Salt contain'd ? Why is it that Vinegar, when reduc'd to a pure Acid by Concentration, coagulates the Blood ? but because the fix'd Salt is taken away : And in Truth, this is the Reason why there are so many specifick Virtues that Medicines enjoy, because so many Adjuncts stick to them, of which we have never taken Cognizance.

In all other Cases, we can pronounce on the Virtues of Remedies very boldly, and with great Security, by knowing what Principles and Principiata they contain ; and even Remedies do not produce other unexpected Effects, without containing some other Principle than what appears ; for

for Oil of Nuts would not dry sooner in Paint than another, if it did not contain less Water and more Earth than other Oils : So that Principles are sometimes loose, and at other times, or in other Bodies, more implicated and strictrlier united, as will appear in the *Second Part.*

These chymical Principles and *Principiata* are sufficient to explain all the Effects of Remedies, if we take in the mechanical Affections of Matter to their Assistance ; for as a certain Philosopher well observes, these mechanical Properties of Bodies are as the Letters of the Alphabet, and the chymical Principles and *Principiata* are as the Words made up of these Letters ; as there are no Words without Letters, so the Words are made significant by them ; and it is by the Conjunction of these Properties that Principles act : These Bodies that act are seven in Number, to wit, there are four Principles, which are Water, Earth, Oil and Acid, and three principiated Corpuscles, which are fix'd Salts, volatile Salts, and volatile Oils ; and one or more of these enter into the Composition of all mix'd Bodies, I say by these along with Figure, Magnitude, Weight, Motion, &c. we can tolerably well account for the Virtues of Drugs never experienc'd before, *a priori.*

Objections are rais'd against the Being or Usefulness of these Principles ; they deny their Existence, and affirm they are Creatures of the Fire.

To this Charge it is answer'd, that although Nitre when distill'd becomes almost all of it an acid Spirit, but when calcin'd it becomes an alcaline fix'd Salt, yet the Objectors have not inform'd us, whether they try'd refin'd or common Nitre ; for common Nitre affords twelve Ounces of fix'd Salt in sixteen, and the refin'd only three in sixteen ; there is therefore a great Difference in our Choice ;

but

but be this how it may, this we know, that Acid is one constituent Part of a fix'd Salt, and Nitre being very porous, as are the Charcoal, they both serve to detain the Acid, and Acid, Earth, with a small Quantity of Oil make a fix'd Salt: All the World must be convinc'd of the Porosity of the fix'd and earthy Part of Salt-petre, when two Ounces of it do so lock up the acid Spirit of Nitre, as to fix twelve Ounces of it and make it a Solid; the Fire does not lessen these Pores, and the Charcoal being also porous, they help to detain it the more: Moreover, they seem to be unskill'd in chymical Processes who make this Objection, because while the Nitre detonates with the Charcoal, a great deal of the acid Spirit flies off, as appears by the Damage the Operator suffers if he stands over the Fumes.

It is objected that these Principles, as all other Bodies, may be transmuted into one another; Water *ex.gr.* into Earth; Mercury into Gold, &c. And as to their being changeable into other Principles, I say, that what we call *Transmutation* is not in Fact such; it is properly and strictly an Evaporation, or a taking off some heterogeneous Parts from the Body, and leaving certain Properties behind, by which we denominate the Remainder; for Example, let the Instance be made in Quicksilver to be transmuted into Gold; it is readily admitted that we can increase the specifick Gravity of Quicksilver to that of Gold nearly, by taking off its acid Parts with Iron or Chalk, its oily Parts by Chalk, and its watry Parts by a gentle Evaporation, or its sulphureous Parts, which are in other Words its oily Acid, by Steel, and by these means the Quicksilver becomes more homogeneal; for these are all foreign to Mercury, it being a certain Earth of a metallick Nature, to which these exotick Parts adhere.

adhere, and may be separated from it, and then the Quicksilver becomes much more dense, as it is made more homogeneal; that Steel is a strong Absorbent of its acid Parts, we need only consult the Paragraph of *Precipitation*, where, if Mercury be dissolv'd in *Aqua-fortis*, it will be precipitated into running Quicksilver by throwing in Filings of Steel; and that Mercury is made more ponderous by a gentle Evaporation in glass Cucurbites, Mr. *Boyle* informs us, and *Centivoglio* tells us, that Mercury by being often precipitated becomes more pure at Bottom, so that he ventures to say, that Gold may be made of it: There is no doubt but the Density of Earths and Metals may be, and are increased by various Methods, so Gold can be brought to weigh specifically $19 \frac{1}{2}$, Copper to near 10, and Quicksilver to 15 or 16, and so of the rest; but can this be call'd *Transmutation*? In Fact, there would want such a Number of Properties to be deem'd Gold, that they deserve to be laugh'd out of such Dreams, and how many Adepts have been ruin'd, and have drawn others after them into the same *Vortex*! I know it has been told us, that Quicksilver has been obtain'd from Vitriol, Copper, Steel, and the like, by Distillation, and that therefore there was a Transmutation in that Case: Weak Men draw Conclusions too readily; it is possible that Mercury may have been contain'd or lurk'd in these Bodies, and it is easily found whenever it is hidden; But is this Transmutation? If Mercury had not been there it could never have been found, but this is not making it. If we divide the Weight by the Bulk, we find the Density of any Body; now the less is the Weight and greater the Bulk, the less is this Gravity; and, *vice versd*, the greater is the Weight under a small Bulk, the greater is the specifick Gravity of that

that Body : Gold has the greatest Weight with respect to its Bulk of any Body yet known to us, to which Mercury is second ; Iron or Copper will swim upon Mercury till their Densities and Surfaces become reciprocal. What Follies have not Men of all Ages been guilty of, to find out the Philosopher's Stone ? And has it not hitherto proved a Stumbling-block to all the Adepts ? For my own Part I am persuaded fully, that whoever searches after Transmutation, attempts an Impossibility. If it were to be done by any Liquor, this ought to give, what it has not, I mean a specifick Gravity, which is impossible ; and if it were to be done by Fire, or somewhat that absorbs all extraneous Parts, then the Earth or Metal only acquires its own specifick Weight, which is allotted it by Nature, and take what Measures you please, Gold may be robb'd of all that is extraneous to it also, and so become specifically heavier thereby. But Earths are distinct from each other from the Creation ; each having its own characteristick Marks.

So that although Disputes have been raised heretofore, and the same are still continu'd, endeavouring to prove a Transmutation of one Principle into another, yet still, I say,

As to a Transmutation of one Principle into another, or of one Body into another, I esteem it impossible for Nature to effect it, and for all the Instances which the ingenious Mr. Boyle has descended to, there needs only this one Answer, that, *Nothing can be got from any Material, but what it previously contained.* Were we to run through all the Objections that ingenious Author has remark'd to prove his Assertion, this Answer would completely satisfy the most inquisitive ; and lest this Affirmation should pass for groundless, give

give me leave to bring a short Detail of all his Proofs, and then it will appear evidently upon how precarious a Bottom his Scepticism is founded.

1. Oil of Aniseeds distill'd 36 times affords Phlegm, Spirit, Salt, Earth, and an acid dissolving Coral.
2. Oils of Amber, of Turpentine distill'd 51 times, give out Phlegm, Spirit, Salt, Earth and Acid.
3. Human Blood is reduced to Water, Spirit, Oil, Salts and Earth.
4. Wine is changeable into Vinegar ; Rain into Fruits ; Guaiacum into acid Spirit ; Nitre gives an acid Spirit ; *Saccharum Saturni* distill'd gives an acid Spirit.
5. Tartar calcin'd imbibes the Air ; Sea Salt with Aqua-fortis distil, and the Salt becomes Salt-petre ; Sandiver affords Sea Salt.
6. Fermentation produces vinous Spirits, but not without it.
7. Oil of Vitriol and Turpentine distill'd, yield a Sulphur.
8. Lead Fumes make Quicksilver a consistent Body.
9. Salt of Wood gives Glass ; Oil of Vitriol and Spirit of Wine distill'd afford an Earth.
10. Filter Salt of Tartar after calcining it afresh, it always affords Earth.

To these Instances a ready Answer is made, by granting that *Bodies are not homogeneal*, and that the *Texture of Bodies may be varied*: The 1st, 2d, 3d, and 9th are answer'd by the first ; and the 4th, 5th, 6th, 7th, and 8th are answered by the latter Concession ; so that what the ingenious Dr.

Dr. Freind said of Mr. Boyle, proves a Mistake, namely, that he had overturn'd all chymical Principles, which I hope to demonstrate to my Hearers to be a Mistake. There is a Heterogeneity in Bodies which is hard to get rid off; nay, so far have Chymists, by all their Industry, been incapable hitherto of robbing Bodies intirely of their heterogeneal Substances, that we content ourselves with having brought them to be nearly of one kind only: Let us, for Example, distil Guaiacum into an acid Spirit, and make it as pure as we can, yet still, when it has stood for some time, it deposites a great Quantity of Oil; in distilling Mustard-seed, the Oil and volatile Spirits do so strictly adhere, that if we would have the volatile Salt pure, it will contain some Oil, and if we have a mind to have the Oil pure, it will contain some volatile Salt: Mercury does contain some sulphureous, and, perhaps, acid Parts too, which are difficult to be separated from it; do we not find that sulphureous Parts stick so closely to calcin'd Bodies, that they are scarcely separable? this appears in diaphoretick Antimony, which may be suppos'd a mere Calx, and yet it affords a Tincture to Spirit of Wine; Vinegar may be separated into Water, Oil, and an alcaline Salt besides its acid Spirit; one Ounce of Oil of Anise-seeds distill'd by itself, affords a great deal of Earth, and but little Oil, insomuch that ten Ounces afford only two Ounces and a little more of pure Oil, which is only such nearly: Oil of Olives in a Pound of sixteen Ounces, affords but one Ounce of pure Oil; wherefore Physicians can only say, that if Principles could be had nicely pure, they would act in such and such a manner more accurately, but as there is an Imperfection in their separating Art, they do attain to their Virtues in as nice a Proportion as is necessary for their Purpose:

pose: What other Cause can we assign for the Superiority one Drug claims over another, but that it contains somewhat hitherto unknown to us, which makes it cure more effectually than another? The Bark, for Example, is the most sure Remedy for Intermissions or Remissions, that we hitherto know of; now there are a great many other Drugs found out to be effectual in these Symptoms, but yet the Bark is by Practitioners agreed and relied upon as the best and chief among them; Why should this excel all others, but because it contains Parts which the others don't, and which contribute greatly to take off the Causes of these Periods, and which we have not as yet, perhaps, taken the Pains to unfold?

In the same manner why should *Opium* exceed all other Drugs yet known, in procuring Rest and Ease? It has no Rival, and all our pretended Narcoticks are neglected and thrown aside as useless: Can nothing be invented equal to it? Do we not exactly know its Principles, and the Quantities of them in a certain Proportion? What then hinders us to frame an artificial Opium? Yet hitherto our Endeavours have been fruitless; there is an *unknown Somewhat* in it, which we are not at present Masters of; and *Lemery* has wisely evaded giving a positive Answer to the Question he proposes to himself about its Individuality, he grants that *Opium* acts by its volatile and gummoso Parts, but then he puts the Question, Why other Remedies that are at once equally volatile and gummoso have not the same Effects? his Answer is, that they don't attract each other so closely as those of the *Opium* do, but separate when they enter into the Blood; but as at the Close of these Lectures, we shall have occasion to treat of Opiates, there is no need of anticipating my Thoughts of it in this Part?

This Peculiarity, Individuality, or specifick Power has been acknowledged by the Consent of all Ages, and a Preference has always been given to some one Drug before all the rest for certain Diseases; and as the want of Industry has been the Reason why strict Search has not been made into this *unknown Somewhat*, it is hoped with good Grounds, that the present Age will hit upon the Reason and Causes of those Specifications, since it is furnish'd with all the Helps that former Ages were Strangers to, since the Inquiry would be of so extensive an Use to Mankind, and since it would add a Lustre to the Profession, and make us Masters of all that offers to our View.

But if it should be objected against these chymical Principles and Principiata, that they don't act without Motion, Figure, and the other mechanical Affections of Matter, and that therefore we have no Occasion for them;

To this Charge I answer, No one is so void of Understanding, as not to know that there are different Classes of Matter cloathed with mechanical Affections; no one can deny they have a Being in Nature, and the greatest use of them is to serve as a *Charakteristick* Mark, to know how many mechanical Affections such Bodies, when nearly concentrated, do constantly and unalterably enjoy; for Example, *Acids* of a certain Degree of Homogeneity do always act by Stimulation, by Effervesing with Alcalines and volatile Oils, by coagulating Oils, and the like: When I say then, that such a Body is *Acid*, I understand that such a Class of Matter, or Concretion of Corpuscles, or Atoms, Elements, or minute Molecules, always retaining the same Form does act univocally, by reason it ever enjoys the same Number of the same mechanical Properties.

It is further objected against these Principles, that some of them do effervesce with others, and are contrary to them, and therefore nothing can be explain'd by them.

This may be answered by granting an Individuality in some of them, which hitherto we have not discover'd but by Experience; however in the main, these very few Acids act as all others do in the Blood, to wit, by Stimulation, Corroboration, and Coagulation; and Dr. Grew well observes, there is a latent Alcali or a Subalcalifate Salt in some of them, which causes them to act in the manner they do.

That these Principles do exist, we call *Analysis* and *Syntesis* in for Vouchers. The first proves their Existence *a priori*, and the latter *a posteriori*; the Fire separates these Corpuscles from each other, and lets us see what all Bodies may be resolv'd into; and Mixtures of Bodies together let us see how Bodies work upon each other: This Method of trying Medicines by Commixion, takes off the common Objection, that chymical Principles are pure Creatures of the Fire.

It is evident by a great Number of Experiments, that Principles do pre-exist in Bodies, and that the Fire does not change them, but only gives them a little Fire; thus from crude Salt Armoniack, by putting a little Lime, or any fix'd Salt to it, we gain a volatile Salt, even without the Fire; Spirit of Wine is obtain'd from Wine in *Nova Zembla*, by the Excess of Cold that freezes all the watry Parts: In like manner Oil of Vitriol mix'd with Salt, Salt-petre, Spirits of Salt or Salt-petre, are obtain'd by or without a Sand-heat, whereas the Fire must be very strong to obtain them; Hartshorn is calcin'd by the Fumes of Water or Vinegar; Gold smel's of Sulphur barely by Trituration; Vitriols and Alum are made in the Bowels of the Earth by

the Acid mixing with Earth; volatile Salts are in Plants by a mere Digestion, and I refer you to the *Second Part* to prove this: From Oil of Olives and Spirit of Sulphur, by Distillation you regain both in their pristine Shape; or if you coagulate Oil Olives by the Spirit of Sulphur, by the first Distillation you obtain a Bitumen, by the second Distillation you gain a Sulphur, by the third you get the Spirit and the Oil pure as before they were mix'd; from whence it evidently appears, that mix'd Bodies do contain those Principles, and that if we gain them, they did certainly pre-exist.

It is not to be doubted or denied, that a good deal of Fire remains in Bodies after that Separation, as in Oil of Vitriol, in fix'd Salts, in Quick-lime, all of which do grow hot by adding Water to them, and when the Fire is out of them, none of them will then effervesce; but then the Fire does not give them Existence, or why should not Sugar afford as strong an acid Spirit as Vitriol? From all which it appears, that nothing is afforded from the Fire but what pre-existed in the Bodies distill'd, and no more is extracted than what the Body contain'd; moreover, as all calcin'd Bodies are absolutely heavier, it appears that the Fire does give this Weight; hence the Fire gives itself only, and separates or unites Principles, but makes none: If Salt of Tartar be long detain'd upon the Fire, it will detonate with Sulphur; from whence it appears, that the Fire gives itself, that is, some Acid and Oil to this Salt, which this Salt readily attracts from it, and which Fuel contains in it: Some Bodies are more apt to harbour Fire than others, as may be seen by the common Experiment of heating a white Handkerchief by the Fire, and taking it into a dark Place, and striking it with your Hand, the Flames it had lick'd up will appear: This brings to my Memory a comical Adventure

of this Nature ; A Servant Maid of a Relation of mine, was surpriz'd for a long time by an under Flannel Petticoat, which when she drop'd in getting into Bed, the Candle being put out, fell all into Flames ; many People of Fashion were call'd in to see this odd *Phænomenon*, and were amaz'd at it, and deeming it the Effect of Witchcraft, they burnt it ; whereas from the Account that was given me by many of those present, and of her Lady and the Girl herself, it appear'd to me she had sat close to the Fire, and had gone from thence immediately to Bed, and the Flannel had retain'd these innocent Flames.

In all the three Kingdoms, that is, whether the Animal, the Vegetable, or Mineral, these chymical Principles are the same, for in each of them we find Water, Oil, Acid and Earths.

However, I cannot say that in all Bodies they are alike concentrated, nor even are they equally pure in the different Chymists Shops ; for Example, Spirit of Salt is made stronger and purer by one Chymist than another, and then these Spirits must differ in Virtues, so far as one has certain mechanical Properties that another has not ; one's may be more rigid, heavier, rougher, more moveable than another ; Earths are by no means Symbolical, for let us dissolve Quicksilver in Spirit of Nitre, and let us also dissolve Bismuth in another Quantity of the same Spirit, and then let us precipitate each with Spirit of Salt, or with common Salt, yet the Pores of the Mercury being less than those of the Bismuth, retain more of the acid Spirit in them, and is therefore stronger than the Precipitate of Bismuth ; nor are Bodies, and therefore neither is Matter, alike, for all Bodies being compounded of these Principles or *Principiata*, must differ according to the Proportion they have of them ; for as each *Principle* or *Principiatum*

cipiatum has annex'd to it a certain Number of mechanical Properties, each Body must differ from another, not only in *Character* but in *Essence*; that is, not only as to our View one Body is distinguish'd from another, as Gold from Silver or Lead, but also one Body has different Effects on human Bodies from another, or upon another Body, from the fewer or more mechanical Properties it enjoys than that other. It is from this Difference that the Sulphur of Antimony vomits, when the Sulphur of Cinnamon does not; that is, that the Sulphur of Antimony contains more refin'd Particles than Oil of Cinnamon and Spirit of Vitriol, which effervesce greatly, but yet don't vomit as the other does; that *Aethiops Mineralis Antimonialis* is more effectual than common *Aethiops Mineralis*, made with common Sulphur; that *Sal Fraxini* will blister, and *Sal Absinthii* is a good Remedy internally.

It may be observ'd, that where any Bodies consist intirely of one Principle, or of the two passive ones, that then they are incompressible into a narrow Compafs, and therefore Gold, which is Earth, and Water which is another Principle, as also Oil and Acid, are incompressible, *quam proximè*; but where the active Principles are combin'd, they by their innate Motions, Attractions, and other Properties, do fall into Fermentations and Commo-tions, and then the Bodies do generally become lighter, and more rarefied: Some indeed, though they effervesce, posseis less Space then when asunder, as Oil of Vitriol and Water, but then the Reason of this is, because the Oil enters into the Spatiola or Vacuities of the Water, and acts as other Salts do that are mix'd with it, which do very little increase its Bulk. Fermented Bodies then, and the same can be said of putrified ones, are lighter than those that have not undergone those

Changes ; for the active Principles are endow'd with opposite Laws, and therefore are they contrary to each other in their mechanical Properties ; it is from these and the *Principiata* that all Vegetation, Sanguification and Animal Secretions do receive their stupendous Changes, as will appear in the Sequel of this Discourse.

The spirituous Principles give the Taste to all the rest, more especially if they prevail in any eminent Degree.

What has hitherto been said of the Principles of Bodies, may be summ'd up under the following Heads ; to wit,

The Principles of Bodies are *Matter* and *Forms* : *Matter* is first and second ; our Business is only concerning second Matter, or extended Bodies, which may be divided into four original, and three secondary Classes ; namely, into four Principles, and three principiated Bodies ; these make this second Matter equivocal or unlike : So that some Bodies are ductile, others are brittle, others solid, others fluid ; some elastick, others humid ; some cohesive, others lax ; some are sonorous, others dense ; some firm and rigid, others rare ; some soft, others hard ; and infinity of other Properties are observed in Bodies according to the various Mixture of these Principles in them ; and these being constantly attended with a set and stated Number of mechanical Properties : Bodies therefore which have such Principles in them, are always observ'd to enjoy such Faculties, Virtues and Properties ; and in Truth, this is all I conceive of Matter and Forms, so far as it concerns Physicians, prescinding however from Matter and Form in the peripatetick Sense ; whether therefore we may say, these Classes of Matter are Forms, as are also the mechanical Properties, I shall not dispute, neither shall I enquire whether these

these mechanical Affections are prior to the Principles, as being an ideal Difference; however this is certain, that these Classes do only act by Virtue of these their mechanical Properties, of which each Class enjoys a fix'd Number; and these Classes accompanied with these fix'd Numbers of Properties are what we call the *Texture* of Bodies, by which all Bodies do act.

As therefore the Taste of Bodies, and consequently the Virtues of them, depend on this peculiar Texture, that on such Matter so modified, so does the Smell; and all the various, or, if you please, all the specifick Tastes and Smells, are Consequences of this Texture: Thus, for Example, we see that bitter Plants may be separated into an insipid Oil and an Acid, and some fix'd Salt; a sweet can be separated into a corrosive Acid and an Oil; an Acerb can be separated into an Insipid by Precipitation; a Bitter mix'd with a Saline into an Insipid; an Insipid into a corrosive Acid; an acrimonious Salt join'd to a corrosive Acid, may be turn'd into an insipid Taste.

In like manner Smells may be varied by changing the Texture of Bodies; thus an Aromatick may be made out of an inodorous Body and a Fetid; and a Fetid may be obtain'd from an Aromatick; or an odoriferous Smell can be made inodorous; or you can raise Odours by Motion, or change a specifick Smell; and they who are vers'd in the Textures of Bodies, which Experiments inform us of, in short, they who make this Knowledge their peculiar Care, can do Wonders in Physick, because they can know all the Effects of Bodies on the Blood and Fibres; as they know their Effects upon each other: And the Trials do square pretty nearly to our Views and Intentions; that is, we know what will vomit, purge, sweat, alter, obstruct, deterge, corrode, irritate, digest, and

and such like, by knowing their Analysis, their Composition and Principles they are made up of; for Example, I see that Sulphur fixes Quicksilver in making artificial Cinnabar, and Æthiops Mineral of any kind; when therefore I perceive any one labour under an excessive Salivation from Mercury, I seldom fail of putting a Stop to this Salivation, by giving Sulphur internally; or if I have no mind that Mercury should flux or salivate, I give it along with Sulphur; I know that Spirit of Vitriol coagulates our Serum, and that Liquors coagulated do adhere strongly, so as not to be capable of being freely circulated, and that Heat which depends on a brisk Circulation, abates as we give plentifully of this Spirit, may I not justly say that it thickens the Blood, and lessens the Circulation, and cools us by this Effect? Spirit of Hartshorn mix'd with thick Serum, makes it thin, and taken internally in a plentiful manner, it causes Hæmorrhages: May I not then, in rigour, say, that it acts on the Serum of the Blood within our Vessels, as it does when blended with the Serum let out of the Veins? In Salivations, whilst we spit freely, Gold put into the Mouth grows white, as it does when Quicksilver is put upon it; in like manner Quicksilver evaporates with a moderate Heat, and thus, whilst Persons are under a Salivation, we keep them warm, and after it is finish'd, we send them to the *Bagnio*, because this Warmth evaporates it, and leaves none behind in the Body: These known Effects depend upon Experiments often tried, and we find they symbolise with these Experiments either with or without our Bodies; wherefore I think proper, before I proceed, to obviate some more weak Objections that have heretofore and of late appeared against essaying Drugs by Experiments and Analysis.

It is objected, that the Secretions, or the several secreted Bodies are no more in the Blood than the Feathers of Birds, and therefore Medicines neither do help nor diminish the Secretions.

There is no doubt that Feathers are materially pre-existent in the Blood, but not in the Shape we see them, or they are not formally there ; for they could neither bud forth nor grow without proper Matter, which is all we contend for ; so neither could the secreted Humours be thrown off from the Blood, if the Matter proper for their Composition were not contain'd in the Vessels, which Matter combines and is thrown out according to the known Laws of Secretions.

It is again objected, that there is no Analogy between chymical Operations and the Functions of our Bodies ; since by the Actions of our Bodies the same Sort of Liquors are separated from any Matter taken in, which does not happen in Chymistry, where only the Principles are separated : The same Nourishment affords every Thing, and we get as much Nitre out of *Nasturtium* nourish'd by Water only, as if it had been nourish'd by Nitre.

2dly, That there is no returning to the pristine Forms ; that an Egg once broken cannot become an Egg again, nor any Seed bruised, &c. to a Seed again : This is not in the Power of Chymistry nor our digestive Faculties ; this is effected by the plastick Power.

3dly, The Chymists assign to Matter which is merely passive, Effects which are due to an original Cause, to wit, that it divides and separates itself into various Particles, and transforms itself into various Shapes and Changes ; that is, that Matter makes Colours, Tastes, Smells, Solidity, Fluidity, and the like ; nay, out of mere Water all the chymical Principles may be generated.

4thly, The

4thly, The mechanical Laws themselves fail us in accounting for the Changes of the Chyles, for the Secretions, for the Generation of Bones, Hairs, Feathers, and such like.

5thly, Heat is the Cause of many Changes, and the Body's Structure and Frame does many Things, for to these and the Texture much is owing.

6thly, There are no such Remedies as Balsamicks or Seminificks; 'tis the Structure of our Bodies that does all.

7thly, Wherefore neither Mixtures of Medicines with Medicines, or the Blood, nor the Heat, or Coldness, or Drynes, or Moisture, or Principles, nor Taste of them avail any Thing to discover their Virtues, for 'tis Experience alone, and the Knowledge of the History of the Disease and Chance, that lets us into the Effects; for what Relation is there between an Acerbity on the Tongue, or an astringent Faculty? Or between an Acrimony and an aperitive Virtue? Or between Borax and Sodering of Gold? Or between Ipecacuana and Vomiting? Or between the mechanical Principles and our Humours and Solids? Or between Mixtures without and within our Vessels? For all depends upon Experience, and it alone opens to us all the Secrets of Nature.

As to the first Objection, it is a ridiculous Assertion, and false in Fact; for as Chymistry depends chiefly upon Motion; whatever a Fire of such a Degree does in chymical Operations, the same Degree of Heat in our Bodies does the same within us; thus it happens, that Perspiration is the Effect of Heat and Motion among the Particles of the Blood, and were such heterogeneous Parts expos'd to the same Heat, or an equal one, the same would happen; that is, certain fugitive and volatile Parts would evaporate: As to the second Part of the Assertion, to wit, that Water affords all

all Things, and therefore will nourish equally with the most nutritive Body ; I say, this is also a weak and fool-hardy Assertion ; for if pure and homogeneous Water were given for Nourishment alone, we should find, in a short time, the Vessel fill'd only with Water, our native Heat, if I may use the Expression, would be extinguish'd, we should fall into Dropsies, our Heart would cease to beat, and Death would ensue : I don't say this *Gratis*, for since the *Hydropsia* has been so much recommended, without Distinction of Constitutions, Temperaments, Age and Measure, an incredible Carnage has been made, much to the Discredit of the Advisers. This Advice has reach'd even to Gouty Persons, where the Fits grew less violent, and less frequent ; but the Consequence was, that the Gouty Humour feiz'd upon all the inward Parts, and destroyed their Functions, and the most warm *Regimen* came too late in to their Assistance ; And who did ever suppose, that one pure Principle alone, as Water, afforded, or can give out more than itself ? And for *Nasturtium* affording Salt-petre, I question the Experiment, unless the Water contain'd Salt-petre where it was nourish'd ; and then Plants suck up no more than a certain Quantity of Salts, if the Part where it is nourish'd be ever so much stock'd with them ; for when the Vacuities are fill'd, all the Remainder subsides.

2dly, To the Second it is granted, but the Objection, if design'd against Principles and principiated Bodies, is of no Force : Who did ever pretend to a Power, in the mechanical Properties, of Creation ? *Seminary and Plastick Powers* are never pretended to by Men of Reason. These are in the Hands of the *Almighty*, and it would be in vain to assign their proper Laws ; but once they are made, I hope we may assign mechanical Laws to explain their Motions. Seeds therefore, Eggs, and

and the like, are not produced by mechanical Laws, there is a supreme Architect, who frames all these Things; but once they are made, we can account for all their Motions mechanically.

3. How far Chymists may heretofore have boasted, when they talk'd of their hypostatical Principles, is not my Business to defend; but thus far we can say in Defence of Chymistry, that it has inform'd us throughly of the several sorts of Particles contain'd in Bodies, of the Difference between volatile Oils and inflammable Spirits, to wit, that the first is less attenuated than the latter, as may be seen under Fermentation and Putrefaction; and by it at all Times we can satisfy our Doubts concerning the various Principles contained, and so account more readily for the Effects of Medicines; for by knowing, for Example, that such a Body contains a volatile Salt in great Plenty, and knowing the mechanical Properties of volatile Salts by Experience and Experiments, we are thereby enabled to pronounce on the Virtues of such a Body with a good Degree of Certainty; and as they move the Blood with some Rapidity, whenever we find by Signs and Symptoms, that the Blood moves too slow, we are naturally led to administer volatile Salts; and whether this Effect follows from the Power of stimulating the Vessels by their pointed Figure, or of dissolving the Concretions of the Blood, or by both, because we experience it acts both Ways, it matters not: And whereas it is asserted, that mere Water will afford all the chymical Principles, it is an ignorant Fiction.

4. I say, the mechanical Laws fail us in accounting for nothing, save the plastick Powers, for the rest are the Effects of Motion, Figure, &c. and their Effects; nor is the *Imperium Animæ* account-

accountable for by Motion ; however, it may be said to act as an *Aura* on our Spirits and Nerves, as the Air upon an Organ.

5. I grant all the fifth Objection, and have endeavoured to confirm it in these Sheets ; and it may serve for a full Answer to the Objectors, if they did not wink, or perhaps nod.

6. The sixth Objection approaches nearly to Nonsense ; for how matters it in what Manner Medicines become balsamick or prolifick, so they at last prove such ? for Example, a Person is barren from certain known and curable Causes ; we take away these Causes by Remedies, and the Woman becomes fertile ; what forbids us to call these Medicines *Prolificks* ? One Cause in particular may be a *Fluor Albus*, which being taken off, the Person becomes fertile : Many Causes may concur to produce this Disease, to wit, a Plenty of Phlegm in the Juices, a Fluxion towards the *Uterus*, a gross State of Humours, and a Laxity of the uterine Glands : Now we know, and can account mechanically for the Effects, what will purge and vomit, what will correct Phlegm, and what will strengthen the Glands ; and surely this is all we want to know ; if there be any further Mystery, I beg the Objectors will represent it.

7. As to the seventh Objection, it is a Jumble of bold Assertions, and a large Encouragement for Empiricism ; it is true that Physick was at first built upon this Foundation, and we may say it went on many Ages without any Addition, except such as diminished the Credit of it ; as any one may observe who will look back into the *Rationale* on Symptoms even within these hundred Years ; but since the late Discoveries in Anatomy, Natural Philosophy, and Chymistry, we have been enabled to proceed from Causes to the Remedies,

dies, and back again from the Remedies to the Causes ; that is, there are certain Signs, for Example, which denote Phlegm to predominate in our Juices, and we know certain Medicines that will alter and correct this Phlegm ; and back again, there are certain Medicines known by Experience and Experiments to correct and attenuate gross and phlegmatick Juices, and where-ever Phlegm predominates, we give these Medicines with Success : So none can fail of Success, but such as are ignorant of the Causes, or where Diseases are incurable : So that whereas heretofore Physicians proceeded by Analogy, we now can reason *à priori* ; we now know the Effects of Remedies, and our Inquiry is only to know whence these Effects are derived ; and as all the Effects of Remedies depend on *mechanical Properties*, we only endeavour to find out, which of these produce the Effects ; so that a long and undoubted Experience having preceded, Reason intervenes, and finds out the Causes of these Effects, and convinces us, that this or the other is the Cause, since by this Reasoning we can argue with Success from the Cause to the Effect, and, *vice versa*, from the Effect to the Cause.

I was willing to answer all these Objections, that my Hearers might not remain under any Doubt, or waver in their Opinions concerning the Method here followed ; and therefore I shall answer one more, which is a very common and noted one ; to wit, That *these chymical Principles and Principiata are Creatures of the Fire*, and therefore they neither are Principles nor of Use.

To which I answer, These Principles are naturally in Bodies, and the *Principiata* also, as I have already said, and as will appear in the Sequel ;

quel ; and as to the mechanical Properties so often mentioned, they are also demonstrable. All these will evidently appear in the *Second Part* ; however, I shall here observe to my Hearers, that all the Principles appear in Milk itself, the earthy Part is Cheese, the Oil is Butter, the Whey is Water, and the Butter-milk is Acid ; in Minerals and Metals, where the Bitumens and inflammable Parts are the Oil, the reguline Parts are Earth, the Parts which exhale with any Degree of Heat are Water, and the saline Parts are Acid, and the same may be proved in the Vegetable Kingdom : Nay, it appears to the Eye, that the *Principiata* themselves are not always Creatures of the Fire ; for the Oil of Orange-Skins, if apply'd to our Skin, and the Leaves of *Flammula foveis* bruis'd and apply'd, will both blister, and Bitters have a fix'd Salt in them naturally, because they blacken Steel ; therefore all Bodies have some one or more of these Classes of Matter in them : That the Principles are formally in our Blood, and the *Principiata* and *plastick Power* or *Seminia* are only or chiefly materially in it ; that the *Principiata* are Creatures of Motion, and the plastick Power has its Existence in an unknown and inexplicable Manner ; that even the *Principiata* are formally in our Juices sometimes, for *Serum* does often make Syrup of Violets green, and precipitates Sublimate white.

From such Textures as we have spoken of, we can account for many Phœnomena very readily : for Example,

When Levity, Incohesion, and Impulse concur, we find it easy to make Bodies mount, as we find in Water.

In Case of *Attractions*, if you would gain the Acid from Gums, we must not blend along with

them any alcaline Salts, but if we would gain the Oil from them, we must add a fix'd Salt to them ; for these Salts would destroy the Acid or retain it, but they thin the Oils : Or Rectification is assisted by absorbing the acid, the aqueous, and gross Parts with Sponges, Spirit of Wine tartarised, Pot-ashes, Lime, Paper, and Salines.

That as gross Parts don't mount, Distillation often destroys the Texture of Bodies; for Tinctures if they are distill'd, the Spirit of Wine is not tinged, because the grosser and colouring Parts remain in the Still.

Mercury makes Gold, and Arsenick Lead, brittle ; therefore as Acids are observed to produce this Effect, we conclude, that as well Quicksilver as Arsenick do contain an Acid in them, which destroy the natural Texture of these two Metals : Water becomes Ice by Cold, and Spirit of Urine a Jelly by rectified Spirit of Wine.

Volatile Salts are fix'd by Acids, and reviv'd by fix'd Salts again, as appears in Salt Armomniack ; hence by Attraction the Texture is alter'd.

Solution is caused by Attraction and Suspension ; and in Fermentations it is necessary the Solid should be first dissolved in a Fluid ; when Solution is gentle, it happens without an Effervescence, but if it be quick, there happens an Effervescence : Salts never act unless they be dissolved : Deliquation is a Solution ; for Example, Salt of Tartar attracts the Water in the Air, or from the Outside of a Bladder, for Salt of Tartar exposed to the Air becomes Oil of Tartar, and if Salt of Tartar be put into a Bladder, and that Bladder be plunged into warm Water, the Salt sucks it in, and makes an extemporaneous Oil of Tartar : Salts of most kinds exposed do deliqueate, thus Salt decrepitated and Crystals of Silver

Silver will run: In like manner all precipitated Bodies must first have undergone a Solution: And Bodies are sooner or later dissolved according to their Texture; for where the Pores are large, the Cohesion is small, and the Menstruum is congruous, elastick, and very moveable, Bodies are soon dissolved: Cohesion is one main Cause of Solution; if small, Solution is easily accomplished.

When the Colour of a Body is changed, its Taste and Smell are changed, that is, when the Texture is destroyed, the usual Effects of that Body are changed.

Whatever is *elastick* is moved by the slightest Touch; wherefore, by a contrary Reason, whatever is *relaxed* requires a strong Impression to move it.

Crystallisation happens from *Approximation and Rest* of Salts, and is promoted by Water, Spirit of Wine, or Acids.

Contrarieties of Textures destroy each other; thus Contraries are precipitated by Contraries; those dissolved by Acids are precipitated by Alcali's; Camphire dissolved in Aquafortis or Spirit of Nitre is precipitated by Water from the Salt in Water; what is dissolved in Spirit of Nitre is precipitated by Spirit of Salt, &c. what is dissolved in an oily Menstruum is precipitated by Acids or Water; Urine is precipitated by Salt.

Medicines act by their Texture, they are apply'd by the contractile Force of the Fibres.

Crystals don't run *per Deliquium*, because they attract their own Particles more than they do those of Air or Water.

Bodies are more attracted when their Cohesion decreases; hence crystallised Bodies are easiest dissolved.

When Attraction ceases, Solution ceases; hence a certain Quantity of Solid is required to a certain Quantity of Liquid.

Sulphurs are the Bond of all Cohesion whatever; hence Salt of Tartar, which destroys Sulphurs, destroys the Cohesion of Vegetables, Animals, and Minerals.

Attraction hinders lighter Bodies from emerging; for Attraction in that Case is stronger than Gravity.

All Liquors have some Degree of Tenacity; Water has the least.

Every Cohesion is not Coagulation; for evaporating the thin Parts of Medicines causes Cohesion, but not Coagulation; for Coagulation is caused by making the Surfaces of Fluids more large.

The best Methods to judge what Bodies contain, are known by Attractions and Precipitations; thus Antimony is known to contain Gold, because it is dissolved in Aqua Regia.

Flexibility depends on a stricter Contact of Parts, and a greater Length of them.

Hardness, *Solidity*, and *Firmness* depend on many Contacts, gross Parts, and a Figure fit for Motion or yielding; some Bodies are so hard, that they become caustick and poison: From this Hardness proceeds this Axiom, *That the harder Bodies are, the more Hurt they do.*

Corrosibility depends on a soft Texture, and wide Pores.

Corrosivity depends on the Figure, Weight, and Mobility of the corroding Parts.

Volatile Salts are small, moveable, light Bodies; but *fix'd Salts* are the heavy, large, and less active.

By the Texture happens it that Oils dissolve oily Bodies; Water, watery ones, and Salts.

The

The Texture of a Body is known by the Strength of the Menstruum that is required to dissolve it; for Lead is dissolved by the weakest, and Gold by the strongest.

Sulphureous Bodies are hardest to calcine, by reason of their Cohesion.

Humidity and *Siccitv* depend on the Texture of Bodies, where there is too much or too little of that Class of Matter call'd Water.

Colours depend also on the Texture of Bodies, as will appear in the *Second Part*; and therefore when they are changed or lost, the Texture of such Bodies are alter'd or destroy'd.

Fluid Bodies are such as have equal Surfaces, that they easily yield to the least Motion and cohere little; for when Particles touch each other in few Points, that is, when the Particles are spherical, they touch in few Points, and therefore they yield upon the least Pressure; Sir Isaac Newton says, that the last component Parts of all Fluids are solid; somewhat like this appears in Water and Quicksilver: *Solid Bodies* have a contrary Definition, their Texture is of an unequal Surface, and their Particles touch in many Points, and attract each other strongly.

Altho' we cannot give Reasons for the Properties of Bodies, yet the Texture of Bodies changes when they are changed; the Qualities of any Body are changed; for Example, Mercury is fluid, but if you change its Figure it becomes solid, and its Effects and Qualities answer to the Proportion of that Change: In like manner, if the Gravity of Matter be alter'd, the Effects which that Property produced are also changed, for the Texture is changed. We often know the Effects of Properties, and we know the Properties from whence are those Effects, whilst we know nothing of the Cause of those

Properties, those are in the Breast of our *Creator*. In short, we know sometimes the Effect, but know nothing of the *Modus* or *Matter*; in other Cases we know the *Effect* and the *Modus*, but not the Matter; and sometimes we know the *Effect*, the *Modus*, and the *Matter*.

All Changes then depend on an Introduction of new Properties, the various Manners of whose Production are not a Subject to be discuss'd here.

Thus, altho' the Blood does contain all the Secretions materially, yet these vary from it in their Texture, in Proportion to the Quantity of the various Classes of Matter and Properties inherent in them; the Spirits, the Bile, the Urine, the Semen, and the *Saliva* were pre-existent in the Blood, but they differ from it; the same may be said of Plants; for in the *Elder*, the *Flowers* are cordial and discutient, the *Stalk* cools and astringes, the *Seeds* are cathartick and emetic, the *Berries* are diaphoretick and diuretic, the *Leaves* are purgative, and the *inner Rind* is emetic and cathartick.

Of the Alteration of the Texture by Coagulation.

This Operation contains many Sorts of Methods under it; howbeit in general, whereforever Bodies from Fluid become Solid, that Body we say is coagulated; hence to inspissate, to make Extracts, to coagulate Bodies into one, and to crystallise, are Branches of this Section: For as Solution disunites the Solids from their Cohesion, so, on the contrary, Coagulation exhales the fluid Parts, and leaves the Solids only behind; Soap, Rheumatick Blood, Butters, Plasters, Balsams, Coagulations, and the rest.

Hitherto

Hitherto are referr'd *Spirits of Salt* or *Vitriol coagulated*, Sulphur of Vitriol, Mercury coagulated.

We make Extracts by evaporating the aqueous or moist Parts, which had imbib'd the Solids into their Pores, and which were there suspended; whether these were vegetable or animal Substances, we make Extracts of either; only this is to be observed, that in Extractions we lose all the volatile Parts; and therefore Extracts of volatile or volatile oily Drugs are useless; but Astringents, mucilaginous Bitters, Neutrals, Acids, Acerbs, Austeres, and earthy Materials are most proper for this Preparation; hence Extracts of Elecampane, of Scurvygrafs, of Brooklime, of Ginger, and such like, are vain and useless Remedies; nay, Extracts of Bitters, and all others, if they are kept a while, grow sour and lose their pristine Virtues; so that of late Years they have been out of use, unless they be very fresh, and it would not be worth a Chymist's Time to be always making Extracts: However, as some Extracts are only Extracts of Extracts, they may be conveniently kept; thus *Aloes* and *Opium* are natural Extracts, and extracting them a second Time is only cleansing them from their Impurities. Moreover, if the same Caution were observed in other Extracts as in these, they would keep long enough, because these are exhaled so as to be solid, and may rather be call'd a Mass of Pills than an Extract; whereas Extracts have a good deal of Moisture in them, and this keeps their Salts in a dissolved State, and therefore in a State of Action, wherefore do the Parts fall into Struggles and spoil the Mass; but in such Extracts as are those of *Opium* and *Aloes*, the Parts are kept strictly united, till our

Occasions call for them. *Vide Extracts under Motion.*

Crystallisation is an Operation performed by dissolving a saline Body in Water, by evaporating, but not boiling the Water, till it has a Crust on the Surface of it, and then we remove this Water from the Fire, and place it in a cool Cellar, and the Salts cluster together, which Clusters are call'd *Crystals*: It is a certain Sign that the Water is highly impregnated with Salts, when even upon the Fire a Crust betrays itself at Top; this is the Case in Consumptive People, when their Water has a Scum upon it, for then it is evident that their Blood abounds in Salts of an acrimonious Nature: The Cold unites Bodies, as Heat dissipates them: Heat is a Principle of Motion, and Cold of Rest; therefore as soon as the Heat ceases, the Salts being placed within their Spheres of Attraction, run together in Clusters.

We may manage Crystals as we do fix'd Salts, namely, by an Evaporation, not Ebullition of all the Humidity, and so leave them at Bottom; but then there would be some Fear of giving them a firey Taste, and therefore it is best to evaporate to a Crust, and to let them run together of themselves.

Fix'd Salts do never crystallise alone; they subside, but if we add some Acid to them, they will cluster and run together; neither will acid Spirits run together, so that neutral Salts, such as Salt-petre, Tartar, Vitriol, and such like, turn into Crystals: However, acid Spirits in Water may be converted into Crystals by a total Evaporation of the Water, or by an Evaporation of a great Part of the Water, as appears in Spirit of Amber; or if you would reduce these acid Spirits into Crystals, you put three or four

Parts of Water to one Part of the acid Spirit, and as much alcaline Calx as will serve to saturate the acid Spirit.

Crystals run into various Forms, some become pyramidal, others rhomboidal, others cubical, and so forth, so that, according to Dr. Lister's Account of their Shapes, it is possible to distinguish to what Tribe each belongs, because as each crystallises apart, it is easy to know which is Nitre, for Example, and which Alum, &c. however, this is not perpetual.

You are strictly to observe in what Vessels they crystallise best, because some do best in Wood, others in Glass, others in earthen Vessels.

There is a Nicety in crystallising Salts to be observed, namely, if you leave too much Water, they will not cluster together, the Salts being placed at too great Distances; and if you evaporate too much, they are under Contact, and their Shapes become irregular, and are not beautiful. In short, the Pellicle or Crust at Top is the distinguishing Mark, that the Body will crystallise as it should do; if we go further, or leave too much Water, the Work will not answer: moreover, the Evaporation must be made without a boiling Heat; a gentle Warmth only is required to evaporate to a Crust.

It is observed, that Spirit of Wine helps forward the Crystallisation of Salts, as it takes up Part of the Water, and adds some Acid to the Salts, and thus may be made the Crystals of Nitre; yet nothing that is bituminous or oily will crystallise, but will be left at Bottom.

Crystals don't run in the Air, as volatile and fix'd Salts do, because the Moisture that is in the Air does not attract the Salt so much as the Salt does the earthy and oily Parts; hence the

Cream

Cream of Tartar, whence Oil and Earth may be got in Plenty, dissolves with Difficulty even in warm Water ; however, all Crystals whatever are not so hard to run, because they don't contain either so much Oil or Earth as Cream of Tartar does.

The Use of Crystallisation is for the Purification of the essential Salt from its drossy Parts ; for 'tis certain, that whenever any Salt is dug out of the Mine, it has a great many exotick Parts, that adhere to it.

The Salts of Metals are Crystals, and *vice versa* those call'd Crystals are Salts of Metals ; thus Crystals of Gold, of Silver, of Mercury, Diana's Tree, also of Copper, and the Salts of Steel, of Lead, call'd Sugar, of Tin, and of Coral, are only these Metals or Stones dissolved in some specifick acid *Menstruum* and crystallised, and they act in the same Manner, but differ greatly in Strength, according to the Weight of the earthy Body and Purity of the acid Spirit that dissolves them.

There is one Circumstance which I had almost forgot to mention, namely, that some Crystals will run *per Deliquium*, and others will not so readily ; thus Salt of Mercury, which will be mention'd in a proper Place, will run if it be expos'd in a Cellar into what is call'd an Oil of Mercury.

Of the Alteration of the Texture by Precipitation.

Whenever a Body is dissolved by a *Menstruum* so as to become invisible, and a third Body is pour'd on, which throws this Body so dissolved to the Bottom, then that Powder so thrown down is call'd a *Precipitate* ; the Body thrown last in

is call'd a *Precipitant*, and the Manner of doing it is call'd *Precipitation*.

Each Body that is dissolved has a peculiar Set of Precipitants, or only one; for, as I said above in Dissolvents, so I say of Precipitants, that Experience alone will inform us of Precipitants.

However, as there are dry Dissolvents as well as moist ones, as I have said above, so there are dry Precipitants as well as moist ones, and in the dry Precipitations it is difficult for Beginners to know to what Head to refer them to: There is, for Example, a Preparation which I have term'd a *Calcination*, yet the Consequence is really a sort of dry Precipitation; thus when we have a mind to return Glass of Antimony back to a Regulus, and the Regulus to Antimony, if we have made Glass of Antimony by any fix'd Salt, the Sulphurs are thereby exhaled, and the Glass becomes pure; if we melt this Glass again, and add Powder of Coals to it, we shall find the Glass return to a Regulus, and if to this Regulus we add Sulphur, the Regulus returns to Antimony again: And indeed there be many other Reductions that could be named which are also Precipitations.

Chymists have assigned some Rules of Precipitation, which, however, are hardly such constantly, because the Bodies to be precipitated and dissolved vary so infinitely, that they can hardly be comprehended under Rules.

Notwithstanding this Difficulty, I shall give my Readers such Rules as will serve to direct them to the Knowledge of proper Precipitants.

First, If any Body has been dissolved in an alcaline Menstruum, that Body will be precipitated by an Acid; for Example, suppose Salt of Tartar be dissolved in any Liquor, it may be precipitated by any acid Spirit; so the Scoriæ of Antimony

Antimony boil'd in Water are precipitated by Spirit of Vinegar into a brown Powder call'd Sulphur Antimonii Auratum.

Secondly, If any Body has been dissolved in an acid Spirit, it may be precipitated by an alcaline Body, of which innumerable Examples may be produced ; thus suppose we take Filings of Silver and dissolve them by Warmth with Aqua-fortis or Spirit of Nitre, we obtain a Precipitate various Ways ; if we dissolve Silver in Aqua-fortis, we may obtain a Calx, which, however, does not amalgamate well with Quicksilver, by reaſon of the Salts that resist this Conjunction. If we dissolve Gold in *Aqua Regia*, we can precipitate a Calx by pouring on Oil of *Tartar per Deliquium*, and this makes the *Aurum Fulminans* ; and in the same Manner we gain *Argentum Fulminans*, by pouring on Spirit of Hartshorn or of Salt Armoniack upon Silver dissolved in Aqua-fortis or Spirit of Nitre ; so if Lead or Minium be dissolved in Vinegar or in distill'd Vinegar, it may be precipitated by any Alcali whatever, that is, by volatile Spirit of Hartshorn or Salt of Tartar ; if Mercury be dissolved in Aqua-fortis, we gain a Turbith Mineral by Lime Water.

Thirdly, Some Acids precipitate each other ; if, for Example, any Body is dissolved by Spirit of Vinegar, that same may be precipitated by Spirit or Oil of Vitriol ; so if Sugar of Lead be dissolved in Water, you may precipitate it out of that Liquor by pouring in Oil or Spirit of Vitriol ; and if, on the contrary, you dissolve Steel in Oil of Vitriol along with Water, this Body is precipitable out of the Oil by distill'd Vinegar ; the best Proof of this Precipitation is when we mix Sugar of Lead along with Salt of Steel, they grow pappy together, because the Oil precipitates

cipitates the Lead out of the Vinegar, and the Vinegar the Steel out of the Oil; so Silver dissolved in Spirit of Nitre may be precipitated by Oil of Vitriol; Spirit of Nitre may be precipitated out of Nitre by Oil of Vitriol, and may be readily call'd off thereby; in like Manner in Butter of Antimony, which is the sulphureous, along with some reguline Part of the Antimony made into an Oil by the Spirit of Salt and Oil of Vitriol, Spirit of Nitre precipitates it into *Bezoar Mineral*: Moreover, Butter of Antimony is the sulphureous Part of the Antimony coagulated by the Acids in the Mercury Sublimate, and render'd thick, and as these Acids are Spirits of Salt and Vitriol, therefore when this Butter is expos'd to the Air, it grows thin, because the Spirit of the Air is a nitrous Spirit or Nitre, and precipitates both the other Spirits, and it therefore becomes thinner.

Take Minium dissolved in the Phlegm of Vinegar, macerate them together for the Space of a Night, then dissolve Mercury in Aquafortis; pour some Drops of the one into the other, and a Precipitate falls, because the Vinegar and Vitriol in the Aquafortis precipitate each other; because these three do precipitate each other, whether, as Dr. Grew, there may not be something subalcalisate in two of them, is not yet determined; nay, Butter of Antimony is even precipitated by dropping it into Water, which demonstrates that the Salt of the Water fixes upon the Oil of Vitriol in the Butter, and the Regulus descends, and this is the famous *Mercurius Vitæ*; Bismuth is precipitated out of Spirit of Nitre by common Salt into a Magistery, which is cosmetick; Gold may be precipitated out of Aqua Regia by Vitriol into a yellow Powder; now as Aqua Regia is only Spirit of Nitre made with

with Salt into Aqua Regia, the Vitriol precipitates out of either the Powder ; in the same Manner Crystals of Copper made by Spirit of Vinegar, and Sublimate Mercury also will precipitate Gold out of Aqua Regia into a fine Calx, because the Copper in the former lays hold of, and attracts the Salts stronger than the Gold does, and down it drops ; and in the latter, because the Vitriol lays hold of the Salts and throws down the Gold into a fine shining Powder fit for Painters Uses, and Gold may be precipitated into a fine red Calx by Pieces of Tin put into the Aqua Regia, which Metal is easily caught hold of by the acid Salts, and down falls the Gold ; this Powder is, as well as Gold in Powder and Regulus Martis Nitrosus, reckon'd a Flux Powder for Rubies, or for making crystal Glass into fictitious Rubies : *Silver* dissolved in Spirit of Nitre will be precipitated by Oil of Vitriol, because these two Acids precipitate each other ; and Mercury dissolved in *Aquafortis* is for the same Reason precipitated by Brine or Spirit of Salt into a fine cosmetick white Powder, which spoils the Teeth and rots them, because this latter precipitates whatever the former has dissolved : so Silver dissolved in *Aquafortis* is precipitated by common Salt or by strong Brine into a white Calx or Powder, which is fusible into the *Luna Cornea*.

There are also individual Precipitants, which throw down one Body by a specifick Attraction ; for Example, if you have dissolved Quicksilver in *Aquafortis*, you may precipitate the Quicksilver either by Filings of Iron or of Copper, for these Metals are more strongly attracted by the *Aquafortis* than by the Quicksilver, and are therefore suspended, whilst the Quicksilver is thrown down, and will ever run : In like Manner, if

if we dissolve Gold in Aqua Regia, we can precipitate the Gold by Vitriol, and then by Steel, these two last attracting the Acid more strongly than the Gold, it drops to the Bottom.

It is, however, certain, that altho' one Body has several Precipitants to perform the same Work, yet some one does it better than another, and we can obtain a greater Quantity by one of them than by another, which makes Artificers to stick to the best; and this appears evidently from hence, that suppose you throw in Vitriol to precipitate any Body out of Spirits of Salt-petre or Salt, you may after this obtain more out of the same Dissolvent by throwing in any fix'd or volatile Salt to the *Menstruum*: wherefore is it best to use the strongest only for common Practice.

Resins are precipitated out of a vinous Spirit either by an acid Spirit or by Water; so Resin of Jalap is got out of Spirit of Wine by pouring the Tincture into Water, and so is the Resin of Benjamin in the same Manner; for there is a Contrariety between oily and watry Bodies.

The Precipitants are highly to be regarded, for the first is lighter than the last; so when we precipitate the Sulphur of Antimony out of the Water, in which the Regulus has been boil'd, by Vinegar, the first is brownish, and the last of a golden Colour, and the others are of intermediate Colours, namely, yellow and saffron-colour'd; now it must follow, that the best is the latest in falling, because it was strongest attracted.

We are also to have Regard to the Liquor from whence Bodies are precipitated, because the Menstruum and the Precipitant do always join together, in lieu of the Body thrown down

and the Menstruum ; hence if any Body has been dissolved in Oil of Vitriol, you may precipitate that Body by any fix'd or volatile Salt, then the Liquor becomes a Salfo-acid, or an Acido-saline, or a Vitriol tartarised, or Tartar vitriolated, according to the Quantity of fix'd Salt you pour in ; for altho' you get rid of the Body you designed to throw down, yet still the third Body or Precipitant stays united with the Dissolvent ; were not this the Case, we could readily rid the Sea Water of its Salt, and make it fresh in an Instant, but that the Precipitant unites with the Menstruum, and Filtration, even thro' a Pumice-stone Mortar, does not rid the Water of this Precipitant, from whence it is plain, that the Fountains don't become fresh from Filtration or by running thro' any peculiar Bodies that precipitate the Salt, but by some other Method which is not yet throughly discover'd ; neither can it be believed that subterraneous Heats distil it, because Fountains have not very deep Origins : But more of this at a convenient Season : However, there is as yet no other Method known but either Precipitation, Filtration, or Coction ; it is demonstrated that neither of the first will answer, and we have no Grounds for the latter ; it is true, that if we mix any acid Spirit and a fix'd Salt together, and distil, we only obtain a Phlegm, according to Mr. Boyle ; but then where is this Fire ?

Not only the Liquor, but the Precipitate itself partakes of the Menstruum, as appears in Butter of Antimony precipitated into Mercurius Vitæ ; for altho' the Water is acuated by the Salts, yet the Powder is still not robb'd of its pure Acid without Calcination or Spirit of Wine ; and to prove this more effectually, this Powder is emetic

tick from the remaining and concenter'd Part of the acid Spirit, and is only robb'd of it by the Manner now spoken of: But what puts this Affair quite out of Dispute is this Observable, namely, Spirit of Vinegar will dissolve Coral, and also Copper; but if you first dissolve Copper with it, or even Coral, and call it off by the Fire again, this Spirit obtain'd from either will not dissolve these Bodies as before, which shews that its most concenter'd Part adheres to the metallick or terreous Bodies too closely to be disentangled without Dulcification by Spirit of Wine, or a strong Calcination, and the same is true in calling off Spirit of Nitre from Mercury, the acid Spirit is weaken'd, and the pure Acid is fix'd to the Mercury.

There is one Thing observable in *Turpetum Minerale*; which is this, if we precipitate it, it may be dissolved in pure Spirit of Salt again, but we can't gain it out of that Spirit again by Oil of Tartar; this is a Paradox which obtains in this Precipitate alone, the Reason of which I leave to be resolved till more Leisure and better Information, only shall observe, that if another Precipitant were made use of, which I know, it would then answer the Purpose; an Example of which is seen in precipitating Mercury out of Sublimate by an acid Spirit; but yet this Sublimate is so far from being quite thrown down by this Spirit, that either a fix'd or volatile Salt will still throw more down: It is enough to remark, that the Precipitant is not strong enough.

Precipitates then are nothing else than Bodies added to *Menstrua* that have dissolved another Body, by which a Powder falls to the Bottom; it is therefore a Species of Pulverification, and upon a serious Consideration, what falls are only the minute Particles, as they were dissolved,

thrown out of the Pores of the Menstruum, and are generally suitable to the Magnitude of the Pores of the Menstruum in which they were dissolved, so that the Precipitant thrown in takes up the Space the Precipitate possess'd before, and upon throwing in another Precipitant of this latter Body, that also will be precipitated into Particles of equal Size with the former.

It appears that there are several Sorts of Precipitants, according to the Menstrua that dissolve the Body; for Oils and sulphureous Bodies Acids may be made use of, or Water itself; so Resins are thrown out of Spirits of Wine by either Water or an acid Spirit; thus is it that Oil of *Guaiacum* sinks to the Bottom of Spirit of Wine or Water, because the acid Spirit or Salt it is join'd with makes it heavy; so some Acids precipitate others, as Oil of Vitriol throws any Body out of Vinegar, and *vice versa*, Vinegar throws down any Body dissolved in Oil or Spirit of Vitriol; thus Nitre, Salt, and Vitriol precipitate other Bodies dissolved in each other, that is, if we dissolve any Body in Spirit of Nitre, it may be precipitated out of it either by Spirit or Oil of Vitriol, or by Spirit or Oil of Salt, or by Vitriol or Salt themselves: One Example may suffice; Let Quicksilver be dissolved in *Aqua-fortis* or Spirit of Nitre, Oil of Vitriol or of Salt will throw it to the Bottom, so will Brine or Vitriol dissolved in Water. There is a Precipitation by specifick Attraction, when the Dif-solvent attracts one more vigorously than another, many Examples of which Sir *Isaac Newton* brings at the End of his *Opticks*; for Example, let Silver be dissolved in Spirit of Nitre, you may throw down this Silver by throwing in Powder of Copper, and the Copper will be dissolved, then take Filings of Iron, the Copper will

will be thrown down and the Iron will be dissolved, to this throw in Zink the Iron falls, throw in Lead the Zink falls, and throw in any fix'd Salt and the Lead falls in Powder to the Bottom; here therefore is a plain Proof that there is a greater Aptitude in the Spirit to dissolve one Body more than another, which Experience alone must guide us in: Sulphurs are dissolved with alcalious Bodies, and precipitated with Acids; so in the Preparation of the Sulphur Antimonii Auratum, the Vinegar throws the Regulus out of the Water which had mix'd with it by the Force of the alkaline Salt in the Nitre; so in the Preparation of Lac Sulphuris, the Salt of Tartar dissolves the sulphureous Parts, and mixes them with Water, and you throw down the Sulphur again into this white Substance; thus Stones are dissolved in acid Spirits and precipitated by fix'd Salts; so Coral is dissolved in Spirit of Vinegar and is precipitated by any alkaline Salt, as by Salt of Tartar, &c. so Silver dissolved in Aquafortis is precipitated by Salt, for then the Liquor becomes an Aqua Regia, and will dissolve Gold; so Flux Powders serve to separate Metals from their Dross and Dregs, the Metal goes to the Bottom, and the Scoriæ swim at Top.

I have mentioned these several Methods of Precipitations, that you may the more readily conceive the Reasons of this Operation; the Body is dissolved and suspended, because the attractive Force of the Bodies is greater than their Gravity and their Cohesion, therefore are they dissolved; and on the other hand, if these two latter prevail, the Union of these Bodies must be broken, and the Powder drops down; hence the Power that parts them must be either a Diminution of the Cohesion or of the Gravity

of the Dissolvent, or an Augmentation of the Gravity of the Body dissolved, or a Diminution of its Surface, there being no other Causes that can concur.

As to the general Virtues of Precipitates, nothing can be affirm'd, they being of so various Kinds ; some are Absorbents, and are readily dissolved in the Stomach, others are resinous and purgative, others again are neutral Salts join'd to Earths, others are corrosive ; so that we must refer our Readers to the Particulars in the *Second Part* for their Virtues.

Under Precipitations come Separations of Metals, so if Silver and Mercury have been dissolved together in one common Menstruum, by throwing in common Salt dissolved in Water the Silver drops into a whitish Powder, and may be regain'd by a little Salt-petre added, and by being fused together in a Crucible ; but the Quicksilver is regain'd by Sublimation.

Thus much may be said of Precipitation indeed, that Poissons may be precipitated, if Physicians are call'd in a convenient Time, into very innocent Bodies, so that if any one by Mistake has taken Sublimate Mercury, as this Poison is soluble in Water, and as Salt of Tartar will precipitate it, warm Water in which Salt of Tartar is dissolved, will prove an excellent Antidote against it ; so that it appears how much the Precipitant takes off from the Acrimony or other Qualities of the Precipitate, and the Virtues which the Precipitates enjoy'd must of Course be lessened or changed into some new acquired ones, since no Precipitation is made without a Heterogeneity of Parts and different Properties.

Mercury dissolved in Aquafortis is precipitated black with Vitriol of Steel and volatile or fix'd Salts ; white with Salt Water or Oil of Mer-

cury; blue with Copper dissolv'd in Vinegar, and Spirit of Salt Armoniac; deep yellow with Spirit of Wine rectified with Sulphur and Salt of Tartar; Orange with Sugar of Antimony, Oil of Vitriol and Water; a Mixture betwixt blue and green, with Oil of Tartar and Copper, in Vinegar and Spirit of Salt Armoniac; white with Copper; grey with Spirit of Salt Armoniac and Water; red Precipitate is made white with Spirit of Salt, and grey with Spirit of Salt Armoniac.

On MEDICINES acting.

Having thus premised all that is necessary to comprehend how Medicines act on human Bodies, we shall now descend to account for their Operations; the Root, from whence all their Virtues are derived, is Matter and its different Classes, which by its *Faculties* or *Properties* conjoined, and applied to our Bodies, produces all the various *Actions* and *Operations* experienced: This is the Cause in all Actions and Functions whatever, for in *Respiration* there must be *Organs* or *Faculties* properly disposed to expand and contract for the Reception and Expulsion of the Air; and these Faculties or Organs are in the *Animal*, which is the Origin of all these Faculties and Actions.

First, Remedies act by Contact, for nothing acts upon a Body, unless it be applied to, or born against it by some Impulse; for Effects are not produced, unless the Cause be actually applied: Hence, if any Part be rendered impassable, and Remedies cannot reach it, no Effects can ensue; and this Impulse being given, the Cause is given and acts.

Secondly, If a Cause be taken away, the Effects *in futuro* are prevented; hence Symptoms

abating, demonstrate the Diminution of the Cause.

Thirdly, Whatever is moved is moved by some other Body, and not by itself; thus Oils and Acids are not moved by themselves, but from some contrary Motion, &c. implanted in these active Bodies, whose Cause it were useless to search, and we know not, but must refer it to the Will of the Almighty; for no Science demonstrates its own Principles.

Fourthly, The stronger are Causes, the stronger are the Effects; so Madness requires almost a four-fold Dose of Opiates, because its Cause is obstinately fixed.

Fifthly, Contrary Remedies produce contrary Effects, unless somewhat hinders their Consequences; hot Remedies heat us, and gross Remedies thicken our Blood, unless somewhat interrupts these their Effects.

Sixthly, Contraries expel each other from the same Subject; we are then to know by Experiments what are Contraries.

Seventhly, All Remedies that work upon human Bodies are not material; for as we are compounded of Soul and Body, Persuasion works upon the former as effectually as Remedies upon our Bodies: The Mind acts powerfully upon the Spirits, even to raise Distractions; wherefore when once the Cause acts, no matter whether it be material, and subject to the Laws of Mechanicks, or Spiritual, and not to be accounted for.

Eighthly, The Effects of Remedies are primary and seconday; the primary are the Principal; for Example, Aromatics do primarily attenuate, and secondarily they astringe and incrassate, because they evaporate Humidities: In like manner volatile Spirits and fix'd Salts do correct Vitriols primarily,

primarily, because they correct the Acid of which they are made; but *secondarily* they relax; for whereas Vitriols contract the Fibres, and occasion Strictures every where, volatile and fix'd Salts taking off the Effects of these Vitriols, the Vessels return to their natural Tone; and this is the Case after Salivations, where often great Damages are done to the Vessels, which are cured of their Strictures by these Salts.

Ninthly, Remedies often cease to do their Offices; for Antimonials if long used fail of vomiting, and the same is experienced even in Alteratives.

Tenthly, Remedies do often agree with some, and not with others; the Reason of which we cannot well account for: Some not being able to bear Rhubarb, others -having an Aversion for Saffron, and the like, which should always be inquired into before we prescribe.

Eleventhly, We are to consider the natural Tone of each Part; for the Ear, for Example, will not bear Aromatick Oils alone, but a Mixture of Oil of Almonds and Aromatick Oils together.

Having observed how Medicines do act, I shall next shew you what are the general Effects of them on the Solids or Fluids, or on both together:

I need not repeat to you the *Causes of Action*, and the *Texture* of the Medicines; that is, some one or more of the Classes of Matter accompanied with certain mechanical Affections, applied to us, since I have so often inculcated it before.

Medicines do by this Texture act on our Solids, by relaxing, corroborating, expatiating or contracting, stimulating or dissolving them; and on our Fluids by adding similar Parts, by obtunding,

incrassating, moving, condensing, and making them cohesive or penetrating, rarefying, dissolving, evaporating, attenuating, precipitating, diluting, absorbing, coagulating and extinguishing Motion ; and on both, by corroding and obstructing, or constipating, &c.

We will descend, with all the Brevity imaginable, to the Explanation of the manner of their Operations in all these different Views.

To *relax a Fibre*, is to make it more extended every way, to wit, in Length and Breadth, by which it is more flexible and dilatable; watry, oily, and rarefying Medicines have this Effect, as also Repletion.

To *corroborate a Fibre*, or *contract* or *crispate* it, is to lessen its Dimensions in Breadth and Length; which is done by Cold or Compression, or Exhalation of Moisture; when Humids are exhaled, the Fibres approach nearer to a Contact of each other.

To *stimulate a Fibre*, is to give it alternate Contractions and Dilatations; for all Stimulants do crispate the Fibres: The lowest Stimulation is a Titillation, and the highest is Pain. *Stimuli* act first in proportion to their *Figure*, and the more acute they are, the deeper are they driven in by any Impulse; 2dly, To their Solidity, for the more Matter a Stimulus has, the deeper does it pierce into the Fibre; 3dly, To their *Contact*, for the plainer and more Surface they have, they stick more permanently in the Fibres; 4thly, To the *Capacity of the Vessel*, for the less is the Vessel through which they pass, the more frequently will they touch the Sides of it, and stimulate oftner. We always pre-suppose an impelling Force in the Blood; and to confirm this last Condition, we find that Orifices are sooner shut

up and closed, than could be imagined ; and that the Medicines arriving at the Capillaries, act more strongly on them than they do on the larger Vessels by the Proportion of Contacts. *Stimulation* is caused by aculeated Medicines of any Sort.

To *dissolve a Fibre* is to corrode it ; which is done by Mundificants, Rubefactives, Vesicators, Escharoticks, Septicks or Causticks, whose manner of acting you will be inform'd of in the *Second Part*.

To *add similar Parts* to our Fluids, requires an exact Knowledge of the Animal Oeconomy ; because they who know not the Nature of our Blood and Secretions, are not capable of knowing what they should administer to supply them ; wherefore this Study is previously necessary.

To *obtund* is to envelope or wrap up sharp Particles, which must be done by what is porous or soft, and then these Points will be buried in these Pores, or cover'd by the soft and smooth Medicines.

To *incrassate* is to turn Fluids into Solids ; for whereas a great Tenuity depends on the Blood's Division into a large Surface, and the fewer Points the Blood touches in, the more fluid will it be, and be less cohesive ; whereas on the contrary, when the Juices are incrassated, they must touch in a great many Points, and stick the closer, and therefore grow thick thereby : It is done various ways, to wit, either by introducing such Bodies as will cause greater Contacts, or by Exhalation of the fluid Parts : Here to incrassate and coagulate the Juices are synonymous Terms : By either the Blood's Motion is hindered ; for thick Juices rub and don't move well.

To *attenuate*, or *dissolve* or *rarefy* the Blood, is to divide it into smaller Parts, by an Intrusion of

of Particles into it, whereby it is rubb'd together ; hence arises a *Heat*, *Effervescence*, *Putrefaction*, or *Fermentation* in Liquors : Heat is always the Effect of Motion, but all Motion does not raise Heat, for we observe that Coral mix'd with Spirit of Vinegar does not effervesce, although they huff together. However *Heat*, which is an Effect of Attenuation dissolves gross Humours, as we see that Jellies or Rheumatick Blood are dissolv'd by Warmth, but excessive Heat thickens them ; for Warmth moves the Particles, which too much Heat evaporates : Whatever is attenuated is made more subtle, less cohesive, and easily separable. By *Rarefaction* is understood a Separation of Particles, or a putting them at a greater Distance from each other ; and hence rarefied Bodies are light respectively, or in comparison to what they were before : Bodies are attenuated then by Commotion or Struggles raised in the Juices ; and these Commotions are raised five ways : 1st, By *Ebullition* ; 2dly, By *Elevation* ; 3dly, By *Crepitation* ; 4thly, By *Effervescence* ; and 5thly, By *Exhalation*. The Blood effervesces, exhales, and also elevates ; some Things effervesce, but are not elevated, as Oil of Vitriol and Water : And as Things will putrify by any one of these Degrees of Commotion, therefore there is no wonder how the Blood putrifies. Juices that are attenuated will easily penetrate into remote and small Meanders.

To *precipitate* is to throw down or upwards various Particles ; those which are light emerge, and those which are heavy fall down : These Effects are observed in our Juices ; for many Things are thrown down by Sediment in the Urine, and many others are thrown off by the Glands of the Skin and Mouth, like Froth. Those which throw down

down Matter are testaceous and absorbing Remedies; those which throw off by the Mouth or Glands of the Skin, are either subtle or heavy Medicines.

To *dilute* is to render our Juices more fluid; Water and watry Remedies are the only Diluents: It is incohesive and of small Parts, therefore it enters easily, interposes itself between the Interstices or void Spaces of the Blood, and renders it more fluid.

To *absorb* is to suck in Acids, aculeated Bodies, Oils or Water into the Pores of any Body; such Bodies are Chalk, Coral, Pearl, all the testaceous Powders, and some others, as will appear in the *Second Part*.

To *alter* is to change our Juices; but this is an ambiguous Term, for to change our Juices may signify to attenuate or incrassate them; however, all Changes are produced on our Solids and Juices by applying Remedies.

These are the *simple Effects* that Medicines have upon our Fluids and Solids, all others may be called *Compound*, because they depend upon several of these simple ones combined; for Example,

Digestives are those Remedies which do relax and stimulate at one and the same time.

Sarcoticks are such Medicines as do relax and stimulate, and at the same time do gently contract the Orifices.

Epuloticks are such as do at once absorb the Humidities, and contract the Orifices, and so heal up the Ulcer.

Constipating Remedies are such as coagulate the Juices, and contract the Fibres, so that an Obstruction is produced.

Promoters of Secretions are such as attenuate the Juices, and stimulate the Emunctories along with such

such apply'd as relax them; so that the Juices may circulate freely to the secretory Duct, stimulate them, and such as will at the same time render them yielding.

Anodynes are such as relax the Nerves, and attenuate the Fluids; by which much is heaped up in the Brain, but little passes.

Repercussives are such as contract the Fibres, and coagulate the Juices, that the Humours may not run forcibly to any Part.

These, and many more are properly denominated, compound and limited Effects, because they depend on many of the simple ones combined; and they are always *univocal*, and are taken always in the same Sense; for Example, an *Epulotick* is such a Remedy as will always absorb and contract, so that such a Term is never ambiguous, it always has the same Meaning: However, it is certain, that some Terms are very ambiguous, and are seldom taken in the same Sense; for Example, an *Otalgick Remedy* is an ambiguous and equivocal Term, for it signifies a Remedy good for the Ear; but as the Ear is not always affected alike, that which is an *Otalgick* for one Patient, will prove prejudicial to another: So an *Ophthalmick Remedy* is a Remedy for the Eyes; but as the Eyes do not always labour under the same Disease, this *Ophthalmick* will prove detrimental to some Eyes. In like manner a *Stomachick* is a Remedy to cure the Stomach; but that which will do the Stomach good in one case, will destroy it in another, for Bitters are good in Phlegm of the Stomach, but if the Stomach be inflamed, they would prejudice the Patient, and endanger a Suppuration there. *Gum Ammoniac*, *Saffron*, *Millepedes* and *Oxymel Scilliticum* are Pectorals, and good in moist

Aftkma's,

Asthma's, but what do they avail in the Hysterick Asthma? Opiates are the best Pectorals in this; so that *Pectoral* is an equivocal Term, and has no limited Meaning.

Whenever therefore you express yourselves, let your Terms be *univocal*; say that such Remedies are coagulating, attenuating, diluting, penetrating, stimulating, &c. or say, they are Digestives, Anodynes, Constipators, Sarcoticks, &c. for then all the Faculty will comprehend you; but to say we must order Pectorals, Cephalicks, Uterines, Neuroticks, Antipleuriticks, Cardiacs, &c. is using Terms below your Dignity, that is, it is making use of Terms that have too much Meaning, or none at all.





P R A ELECTION I.

OF THE PRINCIPLES *called* CHYMICAL.

P A R T I. B O O K II.

I. Of O I L S.



HE Grecians term'd Oils fatty, *λιπαρά* *περιουσίας*; they are indeed distinguished by the following Characteristicks, to wit, they are flexible, unctuous, and inflammable, nor do they mingle with Water alone.

These Bodies may properly enough be call'd *Principles* in the Sense I have explain'd them in the preceding Introduction, since they are no longer changeable into other Shapes, when once we have reduc'd them to a Homogeneity, and then they may truly be term'd *constituent Particles*.

These

These Particles, though in an immature State, or rather whilst they are impure and join'd in with other Principles, do yet appear to exist without the Help of the common Agent, the Fire, as from Milk and Emulsions without Heat emerges a Cream, which by a little Agitation turns into Butter, which has all the Properties assign'd to Oils; and to prove that Milk does contain Oil, we can return Oils into an artificial Milk, by the Assistance of Water and the Yolk of an Egg: A second Proof of Oils being in Bodies, appears from Resins which sweat out of Trees, by some small Breach of a Vessel in the Surface of the Tree. Nay, from Rocks themselves, as well as the Earth, there sweats out an inflammable Oil, which we may call *Petræ oleum*, or *Naphtba*, or *Bitumen*.

How far Oils differ from each other is a Point which hitherto has not been nicely distinguish'd; but I will endeavour to give some Light into it, that we may not be under any Uncertainty for the future; for how infinitely do *Spirit of Wine* and *Oil of Olives* differ from each other in their Taste, Smell, and Effects, or indeed in all their mechanical Properties, and yet both these Bodies have hitherto acquired the Name of *Oils*, inasmuch as they are both inflammable alike; to effect this, I must descend to *Experiments* themselves, which in all our Disputes of this kind are the *Argumenta Crucis* for deciding the Controversy.

It is observ'd, that common Oil, and even the most exalted and attenuated Oils do, with Oil of Vitriol, or with any strong acid Spirit, become *pitchy* or *resinous*, as we see if we pour into Oil Olive Spirit or Oil of Vitriol, the Mixture becomes reddish, and at last blackish and pitchy; nay, Oil of Turpentine, on which is pour'd Oil

of Vitriol, turns red, and then black and pitchy, and the same Experiment holds with rectified Spirit of Wine and Oil of Vitriol.

Oils are observ'd to be divided into three Parts, namely, into a thick Oil, into an *alcaline Salt*, and into *Water*. But we don't speak of these Oils here.

Some Oils are observ'd to sink in Water, and others to swim; of the former Kind are Oils of Guaiacum and Box; as also Balsam of Peru, and some other heavy Oils; and of the latter are Oil of Turpentine, and many other Ætherial Oils.

Oils are truly divided into *Fix'd*, *Essential*, and *Empyreumatical*; *fix'd* Oils are the Oils we speak of in this Praelection: they are thick and cohesive, and in order to reduce this Oil to be an *elemental or principial Body*, we take off its Adjuncts, by distilling it often with Brick, Chalk, or Lime in Powder, till at last it becomes no further alterable; and in this Case some assure us, that only two Ounces of pure Oil are found in ten Ounces, whilst others more exact, declare, that fifteen Ounces of Oil only, afford one Ounce of pure and principial Oil; from whence it may be concluded, that a large Quantity of other Imperceptibles, such as Earthy ones, Acids, and watry Particles are join'd in with the Oil, and that our common Oil fails much of deserving the Appellation of a *Principle*, and that Allowances therefore are to be given for Varieties of Virtues assigned to each individual Oil, from the Quantity of other Principles interwoven into their Composition, so that it is found by Experience, how much more Astringency, or Pungency, or diluting Quality, one Oil has beyond another, from this one Head only: And that every Oil has not the same individual Properties, nor can it therefore be in-

*Individualities
known.*

different to a Prescriber to order one Oil as a *Succedaneum* for another, unless Experience or Experiments have often prov'd this Difference.

This is well known to Painters, for of all Oils, that of Nuts is the most eligible for their Purpose, because it dries the soonest; we must then conclude, that this Oil contains somewhat peculiar in it beyond all others of this Denomination; and this Oil is observed to stuff our Breasts, so as to shorten the Breath egregiously, which other Oils never do: These *fix'd Oils* are readily

*Fix'd distin-
guish'd from
Essential.* distinguish'd from either the *Essential* or *Empyreumatick*, because they feel more unctuous, and they should have no Smell; and ordinarily

speaking they are blended with a good deal of Acid, and the more concentrated this Salt is, the rougher will these Oils be, and also the more glutinous. We may readily enough prove the Heterogeneity of these *fix'd Oils*, by the *Rancor* or Smell they so soon contract, and by the Method of taking off this unsavoury Scent, we easily know and guess what these heterogeneous Particles consist of; and from the small Part that is in such a State corrupted, we cannot fail of determining, that in the Main the whole is safe, and how little of a Body gives a Smell. For as soon as Oils grow old, they begin to smell strong, and their Taste becomes ungrateful and pungent: Now

Vide Ol. Lini. to take off this Smell, we use two Methods, to wit, first we wash the Oil in Water, and then we boil it in Spirit of Wine, and the Smell is then quite abolish'd, and yet we lose very little of the Quantity of Oil; wherefore, as we know that Water is the proper Menstruum for the Dissolution

of

of Salts, and Spirit of Wine for rarefied Oils; it may be inferred, that the Saline, and some of the fine oily Parts are taken away by this Lotion and Coction; and as upon taking off these two Principles, the Smell abates, and is even quite abolished, it is a Consequence that the Cause is taken off, because the Effect ceases; wherefore the *Rancor* is produced from an Attraction of Salts and some Oils in the Mass: To confirm this Advance made on the Cause of this *Rancor*, we find, that upon washing Oil of Linseed in Water, a gross Substance subsides at the Bottom of the Water; as it is observ'd, that *heavy Oils* dropt into Water do sink to the Bottom, and reside there: Now Oils that are pure, or that are laden with volatile Salts, do always swim upon the Water, but such as are join'd to acid or essential Salts do always subside, because Acids themselves, but especially when join'd with Earths, are heavier than Water specifically; and Oils interwoven with such Bodies do always sink. This Matter then which sinks upon washing, is this Salt and this gross Oil combin'd together; and as a strong Argument that this is not bare Conjecture, these rancid Oils do also lose their ill Scent by distilling them over the Helm with any alcalious Bodies, or even by frequent Cohobations; for Acids being heavy, don't readily mount without a strong Fire: Nay, bare Deliquation and Coction will abate and take off any rancid Smell. As this Reasoning proves, that Oils are in their common State heterogeneous, as we shall hereafter prove more at large, so does it also shew us, that *Essential* and *Empyreumatick* Oils are only Corruptions of the *principal Oil*; that is, a small Part of Oil is join'd in with an Acid, and these two attracting each other (as Experience convinces us) do fall into Motion; and from this Action are fram'd some volatile

Salts, whilst the Remainder is yet in Motion, and may be said to be *a volatile Salt in Power*, or the Embryo of a volatile Salt, since by a permanent Attrition of these two Bodies under Motion, this Salt will at last be produc'd: The subsequent Reasonings upon undoubted Experiments, will make this Point evident to a Demonstration. And, if there be any Truth in Authorities, we can gain Oils from the Matter of an Ulcer, expos'd to the Air in frosty Weather; that is, Putrefaction arises from Oil, as from one of its Principles: And in Fact, Pus affords both essential Oils and volatile caustick Salts, when sublim'd.

As a Confirmation of different Matters sticking close to the various Individuals, and thereby causing very different Effects, either in Mixtures or in our Body, we will add a few more Observations; the first of which is well enough known to our Apothecaries, namely, that Sulphur boil'd in Linseed Oil grows hard, but in Oil of Rape-seed, or of Turpentine, it grows soft; which, considering the Effects of Acids upon Oils, fairly proves the Oil of Linseed to contain more of that Principle than either of the other two Oils do. And our common Oil distill'd very often, does yield Water, volatile oily Salt, and Earth; the earthy Part soon appears, insomuch, as at the second Distillation a great deal of Earth is found at the Bottom of the Retort, and the rest appear so slowly, as not to be thoroughly manifest till the twenty-fourth Distillation.

There is therefore a wide Disparity among all natural Oils, according to the various Adhesion of their Principles, but this may be observ'd in the general, that the harder Oils feel to our Touch, the more Acid and Earth do they contain in the Composition, and the thinner they are,

are, they contain the more fix'd or volatile Salts and Water in them, and become the whiter thereby. Of this Kind are *Butter* from Animals or Vegetables made into Emulsion, which upon standing a while, emerge and feel unctuous, as are Resins sweating from Trees of various Kinds ; from Rocks, Earths, and Fountains, where they swim at Top, or subside to the Bottom : And there is a Method, even without the Fire, nay, by the Force of excessive Cold, of gaining rarefied Oils out of Bodies, for otherwise our Sailors could not hack out of their Hogsheads, where their Wine in *Nova Zembla* is frozen, Brandy forc'd into the Centre of their Cask ; nor could we increase the Quantity of Brandy, or rather attract Brandy out of Wine, by barely pouring a little Brandy gently upon the Surface of the Wine, and letting it stand for twenty-four Hours ; for by this Contrivance we draw all the Brandy out of the Wine to the Top : So that it may be said, that Brandy weakens Wine.

The fix'd Oil serves for the Nourishment of Plants and of human Bodies, and out of it are made the glutinous Secretions in Animals, and the Resins or Gums of Plants : How little soever it is suspected to be blended in Water, Trials convince us of Mistake, and it amounts unseen or unobserved into the Root to the Top of the Plant by the Air's Pressure, as it does go round in us by the Help of Protrusion : Our Eyes are too gross and too imperfect Microscopes for the Discovery of Bodies that exist in Water ; for there is no Difference to be observed by them, between common and petrifying Waters. Philosophers make use of more refined Methods to detect the Principles of Bodies in Materials.

Common Oil, by distilling, divides into two Parts ; First, out of eight Pounds of Oil, ascend three Pounds of a clear Oil, and at Bottom remain five Pounds of a buttery Substance, which confirms us yet more in the Opinion of the Heterogeneity of fix'd Oils ; and notwithstanding, if this Body be distill'd often it grows thinner, as it happens to the Oil of Wax, which, being drawn from Wax, is as thick as Butter, but by a Redistillation grows thin : In general then, *Oils are of a grosser or more thin Consistence*, according to their Principles contain'd ; and hence, as all *expressed Oils have a thick, glutinous, and emplastick Consistence*, as common Oil, as Oil of Wax, as this *Consistence is further augmented by Additions of Acids*, as appears in adding Oil of Vitriol to rectified Spirits of Wine, Spirit of Sulphur, or Oil or Spirit of Vitriol, to Oil Olive ; and as appears further, by putting Spirit of Sulphur to Oil Olive, till it becomes very glutinous and pitchy ; and by Distillation, we get a Naphtha or Bitumen, or Balsam : By distilling this Balsam we acquire Brimstone ; and by distilling this Brimstone, we regain the Spirit of Sulphur added at first to the Oil, and the Oil Olive again ; and thus we return to the same Principles, which we had blended together at first. In this Affair, we are confirm'd, that Principles contain'd in Bodies are not Creatures of the Fire, but are only forc'd out of Bodies, where they resided hiddenly ; as *Gums contain more of an Acid in Proportion to their Hardness*, as appears in Gum Benjamin, which, by Distillation, affords Oils of different Consistencies, according to their Parts contain'd, as also different Sorts of Acids ; namely, an acid Spirit, an acid Salt or Flowers, and a strong Acid got from the black Oil and Colophony : The same is evident in *Amber*, which

in Distillation gives out an acid Spirit, which we may call a *neutral Spirit*; that is, we may call it partly Acid, and partly Alcaline; for it tastes acid, and yet will ferment with Spirit of Salt, as an alcaline Body will do: So that we must either say it is *Neutral*, or we must grant that there is a Spirit of Nitre in the Air, which affords the Acid of Plants in the Earth; or that there is a natural Spirit of Vitriol in the Earth, which gives this Acid to Plants and Minerals; or, perhaps, both are true: And it seems to hold good in this Gum, tho' nourish'd in the Sea, or there must be some alcaline Salt in it. An acid Salt, or rather a mix'd and neutral one, because by adding Lime, and by re-distilling, we gain a volatile Salt, as we do from Salt Ammoniac, and an Acid very strong, is got from the black Oil or Colophony; and that the Oil still contains some Acid in it, is evident from this Instance, that if with it we mix a little Salt of Tartar, there is perceiv'd an Effervescence. From Coals themselves, which are very hard, by Distillation we get an acid Spirit, and a neutral Salt so much resembling Salt of Amber, that it is vended by those who adulterate Medicines for that Salt, and it cannot be distinguish'd from it; and from the black Oil we obtain an acid Spirit, which gave it the Consistence it had: Coffee itself contains a butyraceous Oil, which, with Re-distillation, or alcaline Salts, becomes thin.

Moreover, if we put common Oil into a leaden Vessel, and expose it to the Sun, we shall find the Surface of the Vessel to be turn'd white; that is, the Acid which is in the Oil fixes to the Sides of the Vessel, and turns it into Ceruss; or if we put calcin'd Lead into this Vessel of Lead also, and expose the Oil put into this Vessel to the Sun, we shall find the Oil being depriv'd of

its Acid, become clear and thin, and this is a common Method used by Painters to deprive Oil of its Acids adhering.

As yet a further Confirmation of Heterogeneity in common Oils, we bring the Greenness of Brâfs Locks, for they by rubbing them with common Oil turn green, that is, as Acids take the Metal up into their Pores and corrode it, and this Corrosion is a Verdigrase, so this plainly demonstrates that common Oils do contain Acids in them, by reason of their Acidity join'd with their Oil.

Resins themselves are but an Oil thicken'd into that Substance by an Acidity ; they are heavy, and will subside in Water, as we see Resin of Jalap does, when we throw the Tincture of Jalap extracted with Spirit of Wine into Water, and if we distil this Tincture, the Resin remains pitchy at the Bottom of the Retort ; the milky Juice of Jalap exposed till it sours and dries, becomes a Resin, as do the Juices of all milky Plants ; nay, Cucumber Juice does the same.

As æthereal Oils swim in Water, so heavier Oils subside in it, as they do in æthereal Oils ; thus Oils of Guaiacum and Box sink in Water, because they are pitchy and do contain much Acid and Earth in them, but Oil of Turpentine swims on Water ; and Balsam of Peru being heavier than Oil of Turpentine, sinks in it ; and to convince us that it is this Acid and this Earth that gives the Weight to these Oils, as soon as it is forced off, they swim at Top, as other Oils do.

The Oils we speak of here, are Oils join'd to an earthy Salt, and perhaps to some Water ; we don't here mention the *essential Oils* which are join'd to volatile Salts, and to what they call the *Spiritus Rector* or æthereal Oils.

Again,

Again, Varnish is a Mixture which is made with resinous Drugs mix'd with Spirit of Wine and Spirit of Salt, and digested ; the Spirit of Salt gives the Consistence, and thickens the Oils, and makes it stick the better.

Balsams are Oils also, for we can thicken them into Resins, and even into Pitch itself ; they are then a mix'd Body, made up of spirituous, oleous, and Salines blended together ; the *Basis* is Oil, and the other Ingredients thicken, and add Life : As for the Use of this Oil, it serves for supplying the glutinous Parts in Animals and Plants ; it would then be ridiculous to suppose that Water, void of oleous Parts, could supply what it did not contain, or that Plants nourish'd by Water robb'd of these Parts should ever afford Oils by Expression, as we often see they do, especially the Seeds do afford Oils in proportion to what they have received and secreted out of the Water, from whence they were nourish'd : but I will not detain you longer on this Point, having discuss'd it already in the Introduction.

I think it plainly appears that Oil, in the State we have here placed it, cannot be reputed a Principle or a constituent Body, because we have shew'd you what Shapes it puts on, according to the various Mixtures it is accompany'd with, but that it is then only to be reputed such, when by the Fire or any other Means it is robb'd of all these Adjuncts, and neither will nor can receive any farther Alteration ; nor then can we strictly deny, that there may be somewhat still adhering to hinder it from being denominated truly homogeneal ; but however, this we may say, that it is then as much a *constituent Oil* as we can make it ; and when all this is done, we only repute it useful, as it enjoys certain mechanical Properties,

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by which it acts, as shall be observed below; and the only Method we have of making Oils pure and concentrated, is, by mixing Earths or fix'd Salts with them, and calling them over the Helm.

As to the *essential* and *empyreumatical* Oils, which we have spoke of above, they seem to have a near Alliance to each other, inasmuch as where-ever the one can be had, the other can also be got; I take it, that when common Oil turns rancid, it becomes *essential*, or that the Oil and Acid by Motion unite into a volatile oily Salt, and give a Smell to the Mass, of which this oily Salt is not, perhaps, a thousandth Part; so that these Oils are indeed Oils, but they are link'd in with various Mixtures, as shall be seen more at large, when we come to treat of *volatile Oils*: The most æthereal Oils mount first, which are clear, next comes up the yellow, next the red, and lastly, the black or thick Oil; the lightest mount with a small degree of Fire, and the heaviest require a strong Heat: as it happens with Salts.

We shall give you some *Criterions*, by which you may know whether any Material contains any Oil in it.

I. *Whatever contains Oil in it will flame or sparkle* in Proportion to the Oil it contains; and hence it is we conclude that Flint Stones or China Dishes sparkling when struck upon by Steel, do seem to contain Oil in them; but that *Terra Japonica* or *Dragons Blood* do contain more, because being set to a Candle, they rise into a Flame; and that Coals do yet contain most, because they flame for so considerable a Space of Time: One Thing I must observe to you, that the Flame proves the more furious, when the Oils are

are blended with Acids in a certain Proportion, as shall be said hereafter; and the less violent it proves, it becomes the more lasting, if it be blended with Earths, as appears by the Management of some Foreigners, who incline to save Coals, and yet to make a hot and lasting Fire, they take three Parts of Coals powder'd and one Part of Loam wetted, and make the Mass up into Balls and dry them, which they burn upon all Occasions; so that Oils are the Fuel that feeds Fire, and there can be no Heat where it is wanting; so Copper Filings with Salt Armoniack and Sublimate Mercury will flame over a Candle, from the Oil in the Copper and Acid in the Rest; so *Glass of Lead* is oily or sulphureous, because being put into the Fire it deflagrates.

2. Oils detonate with Nitre by the Help of the Fire; thus Salt-petre join'd to Antimony, to Brimstone, to Tin, and such like, do detonate; in like manner does the *Pulvis Tonitruans*, which is made of Nitre, Tartar, and Sulphur, as also the *Aurum Fulminans*, all which making a thundering Noise upon the Fire, do argue a strong Cohesion and a Sulphur: Sulphur as an Oil is cohesive, and the Fire dividing the Parts with Violence, they fly off with great Velocity.

3. Oils do not mingle with Water, unless you add Salt of Tartar or the Yolk of an Egg, or some such Bodies, but do either swim or sink; and therefore when we see a mucous Juice blend with Water, we know some Salts are the Cause of this Solution.

4. Oils or resinous Juices grow milky with Water; thus Tinctures of Benjamin, of Sulphur, and indeed Tinctures made with Spirit of Wine, do all turn milky with Water; and in like manner, Oils grow milky or colour'd with Acids in Water,

Water, as Tinctures of Sulphur or Benjamin are made milky with distill'd Vinegar, and the *Lac Sulphuris* is got from the former at Bottom; so all Antimonials, for Example, the golden Sulphur of Antimony is got by pouring on to a Decoction of Antimony in Water Spirit of Nitre; and Alum added to Waters that are muddy or *motherly*, makes them white, and throws down the Oil by making it heavier, and clears muddy distill'd Waters.

5. Eggs boil'd in Oils or oily Waters, grow yellow thereby.

6. Sulphurs dye Silver of a yellowish black, and Copper, white; for if Sulphur Steams fall upon Copper, they whiten it; hence as the Air tarnishes Silver, it therefore has Sulphur in it; hence the Regulus of Arsenick or of Antimony melted with Copper whitens it; nay, the Steams of Antimony do whiten Copper, and Sulphur Auratum Antimonii, if wetted, tinges Silver of a golden Colour.

7. Salt of Tartar in a Crucible makes sulphureous Bodies red, or of a golden Colour; this Salt is an excellent Absorber of Sulphur; and behold the Reason, why Milk grows red with Salt of Tartar if boil'd together; and hence Salt of Tartar, Iron, or Powder of Talc, which do absorb Sulphurs, take the Tarnish off of Silver.

8. Sulphur burnt affords a blue Flame; hence Coals and other Materials affording Sulphurs burn often blue.

9. Where-ever Sulphurs reside in Bodies, whether Vegetables, Animals, or Metals, they may be call'd off by Oils or oily Bodies; hence Antimony is depurated in Oil; and hence Oil draws a Balsam of Sulphur from Cinnabar.

10. Oils give Tinctures with Spirit of Wine or Wine itself; so *Terra Japonica* and *Sanguis Draconis* give a Tincture out with Spirit of Wine, and Saffron has so much Oil in it as to give it all out to Spirit of Wine, and even to become white without an Addition of Salt of Tartar, and Spirit of Wine only with Salt of Tartar or with Sal Volatile Oleosum becomes red; therefore either these Salts or the Spirit of Wine, or both of them, contain an Oil in them; nay, Spirit of Salt Armoniack join'd to the Spirit of Benjamin, which comes first over, becomes red, which shews that there is some Oil in the Spirit of Benjamin, and these ætherial acid Spirits are call'd oily acid Spirits.

11. So long as Bodies are black, so long they contain Oil in them; and Smoak is a black Oil; and therefore Bones burnt to a Blackness only contain a great deal of their black Oil; nor can they be calcined to a Whiteness, till they are burnt in the open Air, for whilst they are in the Retort the Oil reverberates continually upon them and keeps them black, which flies off if they are calcined in the open Air.

12. Whatever scums up in the time of boiling, contains Oil; for Froth is Oil, and the Scum of Broth is Oil; if you scum off any seeming Filth from the Surface of any Liquor, and lay it by, and you observe it afterwards, you will find it oily, and if you throw it upon the Fire, it will flame.

13. Whatever smells is oily, and Oils are the Source of all Smells; hence volatile Salts and Spirits derive their Odours, as do all Aromatics.

14. Whatever throws up *Scoriae* and swims is oily; for Example, Bismuth and Antimony fused with

with Salt of Tartar, the Scoriæ emerge and melt into Oil ; and Antimony dissolved in *Aqua Regia*, the Scoriæ or sulphureous Scum swims at Top : And because Glass of Lead deflagrates on the Fire, and even penetrates the Crucible, therefore is it sulphureous or oily.

As to the Difference of Oils, it will be necessary to observe, that in Distillation we observe four Sorts of Oil ; first ascends an ætherial or clear Oil, next to that a yellow Oil, then comes up a red Oil, and lastly, a black and thick Oil ; hence the lightest ascends first, and the heaviest last ; and indeed the same Order is kept in Salts, for the light Salts mount first, then the light Oil, next mount up the heavy Salt, then a heavier Oil, and lastly the heaviest Salts rise, and after them the heaviest Oils ; and this Order does Nature observe in all Distillations whatever, the Salts, then Oils, mount alternately.

So that Oils are in Plants in a double manner, namely, they are either alone or join'd to Salts ; if they are join'd to alcalious Salts, they are thin in their Consistence, if to Acids, they are thick and glutinous, or resinous and pitchy, and as most of our common Oils have a Glutinosity in them, this Consistence proves the best Part of common Oils to have a great deal of Acid in them.

Oils are the Basis of all Colours ; and as they are join'd with alcalious or acid or neutral Salts, they become blue, and of any intermediate Colour down to red.

Wherefore as Experiments are most convincing Proofs of this Assertion, I shall give you a Set of them, as I find them and have try'd them to make it good : The Decoction of the Indian Wood is red ; put to it Spirit of Vitriol,

triol, it becomes yellow, then add Spirit of Salt Armoniack, it becomes black; because this Wood plainly contains Oil, and this Oil being variously alter'd, the Colours also vary.

Hence it is observed, that Colours proceed from the same Causes as Tastes and Smells; for if we alter either the Taste or Smell of a Plant, its Colour changes, and *vice versa*.

They depend on a various Reflexion of the Rays, which depend on the Texture of the Bodies colour'd; some Bodies reflect some Rays more copiously than others; thus Minium reflects Rays less refrangible, and Violets reflect Rays more refrangible. These Reflexions are more or less refrangible according to the Salts contain'd in the Body colour'd: Alcaline Salts cause more refrangible Rays, and Acids less refrangible; that is, Alcali's cause Blues, and Colours approaching thereunto, but Acids cause Redness and Colours approaching to it: The thinner Oils are, they refract more; the grosser they are, they refract less; but if alcalious Salts be added in too great Quantity, they, by exhaling the Oils, turn the Oils thick, and occasion Redness, &c. and this Exhalation may be made without any sensible Loss of Weight, as appears by exposing volatile Oils to the Air, where they lose their Odours, but no Weight.

Blue Colours proceed from Oils digested with volatile or fix'd Salts; the Infusion of *Litmus* in Water becomes red with Oil of Vitriol, and blue again with volatile Spirits; the Flowers of *Lathyrus*, which are of a Peach Colour, turn blue with Spirit of Hartshorn; the Tincture of Violet Flowers is bluish, but if you pour in a little volatile Spirit, it turns a fine Blue in an Instant.

Let Flowers of Chamomile be distill'd over the Helm with Oil of Turpentine, and you acquire a blue Oil; the bluer do Oils turn, the more they are digested: Copper with volatile Spirit of Hartshorn or any other volatile Spirit, turns blue; Ultramarine is made of Verdigrease and Salt Armoniack rolled in a Dunghill, but I believe the Spirit or the volatile Salt will be as good, because Putrefaction only turns the Salt Armoniack volatile, and, in Fact, the Vitriol of Copper made with the volatile Salt Armoniack or its Spirit, and exhaled, gives a fine Ultramarine, but not lasting, which however is readily made such: Zaffera melted with Glafs gives it a blue Colour, as does Gold along with Silver, Copper, and Iron; as does Copper itself; as also does blue Vitriol dissolved in Aquafortis and precipitated with Spelter; as does Bismuth, Magnesia, or Copper with Silver melted with Glafs; Aquafortis or Spirit of Salt make green Cloth blue, that is, they take off the yellow; to Tin calcined and dissolved in distill'd Vinegar, by putting on Oil of Tartar, we gain a Blue.

The Green is made *out of Blue* by Spirits of Hartshorn, so Borage Flowers or Flowers of Comfrey, or *out of White* with Salt of Tartar, as from the Flowers of white Daisies; or from Steel with Spirit of Salt; or *out of Conserve of Roses*, Syrup of Cinnamon, Spirit of Vitriol, and Camphire, *a Red* becomes a *Green*, as is usual with the same Conserve redden'd with Spirit of Vitriol and any alcalious Salts, and Syrups of Peony or Buckthorn with Salt of Tartar or a volatile Salt become green: The Juice of Buckthorn and Verdigrease do make Balsams green, as does the Juice of Violets give a greenish Tincture to Gascoign's Powder, and resembles that with Bezoar;

zoar; and it is observed, that no Alcalines or even Neutrals change green Leaves, but that a Green lost is return'd by alcalious Medicines; and thus it is with *Mistletoe* Leaves powder'd, its Greenness fades by Age, and becomes yellow, but if you add ever so small a Quantity of a volatile Salt to the Powder, the pristine Verdure returns; or if you powder *Alchymilla* Leaves, the Powder is green at first, but also fades into a Yellow by Age, but a little Quantity of volatile Salt makes the former Greenness return; both these Powders are reputed anticonvulsive; *Turmerick* gives mercurial Ointments a Green, which are generally of a lead Colur; the Tincture of Iris in Water, with Lime and Evaporation becomes green, and this Tincture made purple with Spirit of Sulphur, and green again with Oil of Tartar; Tincture of Saffron with Roses is green with Oil of Tartar, and yellow with Spirit of Vitriol; and distill'd Waters from any green Plant, except from Cherries, Roses, and some others, if to them you add Oil of Tartar, they grow green.

The Yellow becomes blue with green; for, as I have noted before, Green and Yellow make a Blue: Spirit of Sulphur changes a Blue into a Yellow, that is, it takes off the Green, and leaves the Yellow; common Salt makes Gamboge and *Turmerick* give out their Yellow to Balsams; sublimate Mercury gives a Yellow to Chalk or Ceruss; Spirit of Salt gives Copper a yellow Tincture; a Decoction of Indian Wood is red with Vinegar, but add Spirit of Vitriol and it becomes yellow; *Aquafortis* or Spirit of Salt turns a green Cloth into a Blue, namely, it gives a Yellow, and Yellow and Green are a Blue; black Silk with Oil of Vitriol turns yellow; Tincture

of Salt of Tartar is red, if fresh, but yellow, if old ; Salt Armoniack sublimed with Lapis Hæmatitis is yellow ; make a Tincture of Brasil with Water and a little Spirit of Salt, put in Spirit of Urine you have a Yellow.

The Red is of different Sorts, namely, the Red, the Purple, and the Scarlet ; the blood Red or Crimson is made by an acid Spirit as well out of Red as Blue, for Rose-Buds and Violet Flowers become red by Spirit of Vitriol ; Gum Lacca with Salt Armoniack makes Balsams red ; Spirit of Nitre upon Borage or Comfrey Flowers make these Blue into a Red ; but it makes no Change in the red Flowers of Lychnis ; Acids, nay, Alum alone will turn the Dutch Turnsole into a Red ; and as for the *Purple*, a strong Infusion of Rose-Buds, Strawberry Leaves, of Raspberry Leaves, of Gooseberry Leaves, of Primrose Leaves, of Bistort, and such alcalious Plants, do give to a Tincture of Steel or Steel-waters a Purple ; and a Decoction of Pot-ashes, or a Lie of them decanted, adding a little Soap to it, a purple Colour ensues, which will die Silks purple ; red Flowers turn into a Purple with Gas Sulphuris, but with the Spirit of Sulphur in it to a Red : as to the *Scarlet*, we get out of Cochineal, boil'd in Water in a tin Vessel, and Spirit of Nitre, a fine Scarlet ; if we rub native Cinnabar in a Mortar with a little Salt of Tartar, it becomes a *shining Red*, and it will then make a fine Red for Printers, if we put too much Salt of Tartar to it, it will then turn *yellow* ; and if we put an Acid to it, it becomes a *very dark Red* : *Red may be taken away by an Acid*, as we see it happens to Apothecaries Apprentices when they bruise their black Cherries, their Hands become very red, and they take it off with washing their Hands

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in Water into which they have pour'd Oil of Vitriol, for too much Acid corrodes the sulphureous Parts, and then the Colour vanishes; a Decoction of Acetosa Roots gives Water a deep Claret Red.

The Black affords no Reflexion or Refraction, all Rays are absorb'd; it is generally observed to be made out of Bodies burnt; so that Printers Ink is only Ivory burnt to a Blackness and powder'd and made up with Oil; and this Burning is not a complete, but a half Calcination, for if we calcine in an open Air, and sufficiently, so that the pitchy Oil and Salts fly off, then the Bodies become white; Arsenick becomes black with Oil of Tartar, or with Lime and Sugar of Lead; for the *Arcanum Scriptorium* is Arsenick and Lime digested together into a volatile oily Salt, which blackens the Sugar of Lead dissolved, by a sort of Precipitation, as will appear more hereafter. If to a Decoction of Rose-Leaves we put Vitriol, or if to Steel-waters we add Galls in Powder, especially if the Galls be roasted, we have a Black: Lamp-black is the Soot of Pitch, or it is a pitchy Oil; the Solution of Silver in Aquafortis dies the Hair black; and *in all Dies Silver* is observed to give a Black; as does Iron; and the Vitriols of the Silver are bitter and styp-tick, whilst those of Iron are sweetish and styp-tick: Antimony with Aqua Regia is ash-colour'd, but sublimed with Salt Armoniack it gives all Colours: Acids prevail in Black; Juice of Lemons, Bezoar, blacken Iron.

The White is look'd on to be an Assemblage of all Colours, and is therefore call'd a heterogeneous Light, because at the Focus, Rays of all Colours are exactly blended together, and may be separated: Things throughly calcined become

white; Flowers of Sulphur become exactly white, if they be dissolved in any Liquor with Salt of Tartar, and precipitated with distill'd Vinegar; yellow Amber boil'd with Sea Salt turns white; and yellow Wax boil'd in Spirit of Wine also becomes white; Saffron, which is yellow, by the same Spirit of Wine becomes white; yellow Arsenick sublimed with Sea Salt becomes white; Arsenick gives Copper a white Colour.

From these Instances it may be gather'd, that the Blacks and Reds contain Oils thicken'd by Acids, and that the Greens to the Blues do contain Oils variously attenuated; so that the most refrangible Colours do argue alcalious Bodies attenuating the Oils to a certain Pitch; which Pitch, if changed by too great an Addition of Alcalines, is extremely alter'd, and even the Colour descends into a Green or a Yellow, inasmuch as the Oils are evaporated by such Additions, and the Remainder is left grosser and thicker; and on the other hand, the least refrangible Colours are occasion'd from a Mixture of Oils and Acids; these Acids in a certain Degree do incrassate the Oils, and make the Colour of the Body approach to a Red or Black, and yet if we add too large a Quantity of Acids, these Reds become again yellow or green, or of some more refrangible Colour.

Supposing this Assertion to be drawn from Experiments made, it will hold true, that the thinner Oils are made, the more does the Colour approach to a Blue, and the thicker, the more to a Red or Black; and that if by adding to a Black or Red any acid Spirit, the Colour becomes more refrangible, we must conclude that this Acid has really attenuated the oily Parts in the Body, or that if by any Addition of volatile Salt

Salt to Blues, the Colour becomes even a Red or Black, we must conclude that the Oils have been thicken'd by this Addition, which has changed the Colour. Now there is no Difficulty to conceive, that an Acid in too great a Quantity, or a small Quantity of a concenter'd Acid will render an Oil too thin, or that a volatile or fix'd Salt will render an Oil too thick, because Experiments fairly evince the Facts; for Oils are really eroded by too strong Acids, and are made too thick by adding too much Volatiles, which evaporate their thinner Parts: As to the first Part, do we not see that Spirit of Nitre dissolves Butter of Antimony and Camphire? and as to the latter, do we not know that Soap is made by Salt of Tartar out of Oil, and that empyreumatick Oils, if long kept, do become rigid? And what other is the Case of rheumatick Blood, but that the volatile Salts being too copiously contain'd in the Blood, do exhale the watry Parts, and leave the Particles glutinous, that is, the Oils and Salts are accumulated, and want the Intervention of watry Particles?

What Construction can be put upon the Change of volatile Salts from a White to a Red, when exposed to the Air, but that as the Air contains, according to various Experiments, a good deal of Acid in it, and that volatile Salts do, according to Experiments also, contain a good deal of Oil; these Oils being strongly impregnated with the Acids of the Air, are incrassated, and the volatile Parts either fly off or are ty'd up by them, and therefore they become red; and if Tartarus Vitriolatus be mix'd with Salt-petre and Quicksilver, and sublimed, the Mercury that sublimates is red, from the Acids join'd with it.

It is an Observation, and a very remarkable one, that Rubies and red Coral by being worn next the Skin, do grow paler ; it is certain, and shall be proved by Experiments when we come to the Practical Lectures, that our *Perspirabile* is a volatile oily Salt, which enters into the Pores of these hard Bodies, and takes off their Red : Is not this a very plain Instance to convince us, that the Colour of these Stones is mutable, and is somewhat not very much fix'd, and as volatile oily Salts do take off the Red from them, it is by a Change made in their Sulphurs, that is, their Sulphurs are attenuated, and the Colour is exalted into a more refrangible one ; and by a contrary Argument to convince us further of this Proof, the Powder of red Coral is made much redder, if we add to it, in the Time of pulverising it, any acid Spirit ; and to shew us that this Colour of Coral is somewhat oily or bituminous, it is very well known, that we can extract this Colour from it by the Assistance of white Wax ; for if we take Coral and put it into white Wax, and let them stand upon the hot Embers for a Day or two, the Wax becomes *yellow*, and the Coral white ; more Coral managed in the same manner in the same Wax, the Wax, with this second Quantity, becomes *brown* ; and if we add more Coral to the same individual Wax, and let 'em stand still upon hot Embers, the Coral becomes white, and the Wax then is red : Oils then, and especially volatile Oils, rob Coral of its Sulphur, or change it into a more refrangible Colour, and Acids heighten its Red, and lessen its Refrangibility.

What may we not say of a *Yellow return'd* at pleasure into a *Green*? As we have mention'd in *Mistletoe* and *Alchymilla* Leaves powder'd, don't the

the volatile Salts act on the Oils afresh, and exalt their Refrangibility? This Experiment holds good in *Gascoign's Powder*, which by an Acid is taken off from the Paper or white Wood, and is return'd into a *yellowish Green* by Spirit of Harts-horn, or by any other volatile Spirit: This shews that the Bezoar contains some Oils, which are eroded by an acid Spirit, and restored by an alkaline one. Do we not see a Tincture of Madder, which is red, made into a Blue by volatile Salts, and return'd into a Red again by Oil of Tartar? The volatile Salts make a less refrangible into a highly refrangible Colour, and the Oil of Tartar returns the Red again: Now let us reason upon this Phœnomenon a little, according to the Principles we have hitherto found true; Red is made into Blue by reason the Oil is highly attenuated; and this Blue is return'd back into Red from an Incrassation of the Oils; and that Oil of Tartar does coagulate Oils, we shall shew in the Sequel.

Do we not see that the Syrups of Peony and of Buckthorn are red? and don't we observe how suddenly this Red changes into a Green by either volatile or fix'd Salts? And this proves that volatile and fix'd Salts do correct the Acids in these Syrups, and do attenuate the oily Parts.

Is it not pretty to see that Gamboge distill'd should make a Purple into a Green? for the Salt it affords is volatile, and this upon purple Paper turns it green.

Electuaries are observed to turn *red* if made of Honey or Sugar with Acids; red Wines turn yellow with Oil of Tartar, and red again with Spirit of Sulphur; to become *purple* with alkaline Medicines, and to turn *black* with Vitriols of Metals: Acids have the Predominancy in Reds, Alcalines in Blues, and therefore in turn-

ing into Purples, so far as they advance the Blue ; and Vitriols of Steel or other Metals turn 'em into a Black, by reason of the Raments of porous Matter.

Magnesia turns *Glaſſ*, which would otherwise be green, into a Transparency, and it even blackens it, if we add too much of it ; the Oils are evaporated which would have given Colour, or it sticks too close, if there be too much of it.

Why do the Juices of all Plants, especially of Betony, grow *red* upon standing, but that the Acid turns out from its Wrappings, and acts upon the Oils ? And do we not find that even Bitters and Aromaticks themselves infused become redder by Acids instill'd into them ? And hence comes it to pafs, that a stomachick bitter Tincture becomes more beautiful by adding Spirit of Sulphur to it ; we are well assured, for Example, that Orange Peels and Gentian Root do contain Oil in their Composition ; and we see by Experience, that Reds are made by Acids ; therefore the Oils in these Drugs are in ſome degree thicken'd by this Acid, and the Colour becomes red, or the least refrangible.

The *redder Oils* are, the more Acid they contain ; and the *more blue* they are, the more volatile or fix'd Salts do they poſſeſſ ; and the middle Colours are blended with Acids and Alcalines, according as they approach to Reds or Blues ; that is, the Yellow and the Green partake of neutral Salts acting in divers Manners upon the Oils, ſo that the Body can't be term'd homogeneal, but is different in its Texture all over the Mass ; for Example, Oil of Hypericon digested is of a blue Colour, and ſo is Oil of Turpentine distill'd over the Helm with Chamomile Flowers, because these Flowers do give Syrup of Violets a Green, and

and Hypericon is an Aromatick, and therefore is a volatile oily Salt, and no Wonder then the Oils should be attenuated so as to reflect a blue Colour.

Bile, which naturally is yellow, and is an oily Substance, becomes green by adding either Spirit of Vitriol or Nitre, which argues that these Spirits are Alcalino-acids, and they will appear by many Instances to be such, in the Sequel of these Lectures.

I think it appears by all the foregoing Experiments, that the most refrangible Colours depend upon volatile Salts united with Oils, and the least refrangible upon acid and heavy Salts join'd to the same Oils, and that whilst the Oils are render'd thinner, the Bodies refract most, and when they are thicken'd, they refract least; and if by any Accident the Oils should be thicken'd by volatile Salts, or render'd thinner by Acids, as we have shewn they may, then the Colours still follow this Attenuation or Incrassation.

There are some Difficulties as to Refractions, which are hard to answer; for Example, Water refracts Light the least of any Fluid, but if it is impregnated with Salts, it then refracts in Proportion to the Salts it contains; and this holds good in the *Aqua Stygiæ*, which refract Light much; and again, ætherial Oils and Brandy Spirits refract Light to a great Degree: But if we consider the Number of Vacuities in Water, and the Quantity of Salts it will receive, without any Increase of Bulk, into its Pores, we need not wonder at its absorbing the Rays, or even refracting 'em so little; but when its Pores are fill'd, then the solid Parts contain'd in it do strongly reflect the Rays; and as Oils are cohesive and closely

closely united, they also do refract Light very much: but as to *Spirits*, altho' they are light and incohesive, their polish'd Particles refract strongly.

From these Reflexions on Colours, I think it appears pretty evidently, that we can guess as well at the Texture or Consistence of the Oils in a Body, and consequently at what Salts are predominant in it, as we can tell by the Taste and Smell what Principles Bodies contain; and I believe this small Sketch on Colours, pursued by such as have full Leisure, will at last also arrive at an useful Pitch for Physicians to determine on the Vertues of Medicines; for I look upon us obliged to carry on every Hint towards an Improvement, till we complete it: It is true, that it will never be so safe to trust to this alone, because the same Colours may be produced by different Salts; for Example, a Green may be produced as well by an Acid as an Alcali, and so of the rest; but if we trust the Taste also, then we are more confirm'd in our Conjectures; thus if what appears green have *also* an acrimonious or bitter Taste, then we are confirm'd that such a Body contains either a fix'd or volatile Salt, because these Plants afford such Salts, and because Greens ordinarily are produced by a large Mixture of such Salts.

These Observations may stand the Test in Vegetables and Animals; but as to Minerals, and especially Metals, there may remain some Doubt, since Metals added to Earths do give Colours to them, as appears in the following Instances; it must, however, be said, that a *certain Degree of Refraction produces each Colour*, let that Degree be produced from what Cause soever, and as their Union has these Effects, so that Glass

Glass can be variously tinged and give out such Colours, there must be somewhat analogous to Oils rarefied or thicken'd to such a certain Degree, when such and such Colours are produced; because we have few Footsteps of Oils in Gold, Silver, Mercury, and the rest; and yet it cannot be question'd, that there is in Metals themselves somewhat analogous to Oils, or how should they be render'd ductile or brittle at pleasure? in general it may be observed, that *Metals are made brittle by Acids, and ductile by Oils or volatile oily Salts;* this being Matter of Observation, we need only mention the Experiments themselves to convince us; for we see Lead, which is an oily Metal, as appears by its Glafs, will break into Shot or Bullets by adding a little Arsenick to it whilst you are melting it; Metals become brittle by being melted with Sulphur, from the Acid in Sulphur; Gold becomes brittle, if to it you add Antimony when it is in Fusion: now we know that from Antimony we get a Clyffus, which is an acid Salt: Tin melted with Lime and thrown into Water turns into Sand: now Lime has both an alcalious and an acid Salt in it: Copper, like Lead, melted with Arsenick becomes white and brittle, and as Arsenick is precipitated with Oil of Tartar or Spirit of Urine out of Liquor, we conclude it contains an Acid in it; on the contrary, Iron, which is brittle, is render'd elastick and ductile by calcining it with Horns or Hoofs, which we know to abound with a volatile oily Salt: From all which it appears, that the oily Parts of Metals do receive Alterations as softer Bodies do, and are either coagulated, and then they become short and brittle, or attenuated, and then they become flexible, ductile, and tough or elastick; and I
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don't question but this Hint may be made very extensive and useful to our Shipping, if it were thoroughly consider'd ; for it is a known Observation, that our *English* Oaks don't splinter, as foreign ones do, in Vessels of War, which makes them more valuable for this Ductility : Now it were worth while to enquire what Difference there is between a brittle and a ductile Wood ; doubtless it would be found to consist in the Condition of the Oils in these identick Woods, namely, it would be found that the Oil of our *English* Wood was in a State of Attenuation, whilst that in the foreign was coagulated or exhaled ; and I make no Doubt, if this Enquiry were carried to a true Pitch, but *English* Oak would be made as brittle as the foreign, and the foreign made as ductile as ours.

Having in this Lecture given you a full View of the Nature of Oil as a Principle, and having given a Detail of its Properties in Mixtures, and of its different States, it is now incumbent on me to enter into its Medical Properties, which is the main Design of these Discourses.

First then, They are *soft and flexible*, by reason of their Texture, which is loose, and by this Texture they *relax* our Fibres: By Relaxation I understand any Enlargement of our Fibres, whether in Length or Breadth ; as in all Flexions towards an Arch, the Fibres on the upper Part are lengthen'd, whilst those below are shorten'd, we may properly enough affirm, that the upper Parts of that Arch are relax'd, because lengthen'd ; it is a Property of a Fibre to be extended and contracted : Whether in these States any thing apply'd to these hollow Tubes enter 'em or not, is a great Question : I am more inclined to believe the bare Contact produces all Changes necessary ;

necessary ; for let us suppose that Emollients enter the small Canals, then they will be fill'd, and will be increased in Breadth, and consequently will grow shorter, since whatever fills a Vessel, shortens it, and unloading a Vessel is lengthening it. We only know that Fibres are elastick, and we know how to increase or lessen that Property by Art ; we know that Oils and oily Bodies have this Effect ; whether any natural Reason can be given for Oils relaxing Leather or our Fibres, I cannot affirm ; perhaps the Warmth of our Skin puts the Oils, which of their own Nature are cohesive, into a repulsive *Nisus*, and flying off on all Sides from the Fibres, to which they adhere, they draw them into the Dimensions of Length and Breadth : however true this Conjecture may prove, the Facts are stated and regular ; for Oils do relax the Fibres, whether carnosus or nervosus, but Bones grow tougher with Oil, because without it they are brittle : If then our Fibres are too much dry'd, shrivell'd, crispated, or corrugated, if our Canals are too narrow, if our Limbs are contracted, Oils are the surest Relief ; if we inject Oils into the *Vertebræ* perforated, a Palsey ensues, from the Relaxation of our Nerves : And as the Hardness of Fibres depends on their too near Approach to each other, in every Dimension, as well as their Incurvations, so Oils, by relaxing them, do lengthen them and make their Position more direct, so that their Hardness diminishes of Course ; hence do we use them in hard Tumours of the Breast or elsewhere, as also in rough and hard Skins, or in Pits from Small-Pox, that the unequal Part may rise up into the sound ; and even they are used to soften Excrements, or to cure Cramps of the Limbs : This relaxing Property besmears the Surface of
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the Fibres, Oils being strongly attracted by them, and disengages the adhering Humours, or enlarges their Passages, and makes Bodies glide off.

Secondly, *Oils are porous*, and do therefore readily admit of pointed Bodies of any kind into these their Pores: Hence may be assigned the Reason, why Oils do obtund Salts, whether acid or alcaline; for hard Bodies do readily enough pierce into soft ones. Various Experiments may be produced to convince you of this Obvolution; for if we add a little volatile Salt or Spirit to Oil of Almonds, or indeed to any other Oil, and stir 'em well together, we can perceive no Smell left, or any Taste given to the Oil; or if we blend a little Oil of Tartar, a little Lime-water, a little Sugar * of Lead, or a little Spirit of Nitre with any Oil, we shall perceive no Alteration of Taste: This is indeed the Case of Milk or Sweets, where an Acid is really contain'd, but we perceive nothing of that Taste in these Bodies, because they are sheath'd, and therefore conceal'd to our Palate. Moreover, if we add to any fermenting Liquor or Body oily or fatty Substances, they put a Stop to the Fermentation; for Example, if to working Liquor we throw in Oil or Lard, we stop the working, or if to Leaven we add Oil, it works no more, or if to working Ale we throw Jalap in Powder into the Vat, the Liquor subsides and leaves off working, or if to Coral and Vinegar we add Oil, they cease from huffing; and the Peruvian Bark added to Ale whilst it is working, does immediately put a Stop to the Fermentation; it is also observed, that Spirit of Nitre is so sheath'd by the Quantity of Oil in Camphire,

* *N B.* Sugar of Lead and Oil make the nicest *Unguentum Nutritum*.

that

that altho' Camphire be a volatile Oil, yet neither a Heat nor Ebullition ensues. The Reason of these Phœnomena will appear when we speak of Acids and their Properties; but at present it shall suffice to say, that there is required to produce a Fermentation a certain Proportion of Oils and Acids, which if not observ'd, there is an End put to it; because the too excessive Proportion of Oils sheathes and blunts the Acids, so that they can't exert their Activity. It will be manifest then, how Oils do allay *Pains* by sheathing the Stimulus that occasions them, or how *acrimonious* Humours of any Species are obtunded and wrapp'd up in safe Covers, so that they can't much prejudice Mankind, or how Irritations are appeased by them, or how they are profitable in Ulcers respectively, since these are Consequences of their Porosity, and of the Admission of the aculeated Parts into their small Caverns: When we come to recite the Virtues of the Individuals, we shall descend to Particulars; as they prevent Drunkenness, it must proceed from the same Principles.

Thirdly, They are *light and cohesive*; the volatile and ætherial Oils, which are Oils and volatile Salts united together, and of which we shall speak hereafter, agree in this Quality of Levity, being the lightest Bodies in Nature, yet they are not cohesive, but very active; these principal Oils have a small Quantity of Matter in them under large Surfaces, and therefore by any Impetus or Velocity whatever, their Moment is small, and consequently they are easily resisted, but also their Cohesion occasions them to resist the Velocity impress'd on them, so that upon both Accounts, Oils move slowly forward, and are apt to stop at the least Resistance; it is an odd

odd Composition and Texture to be lighter than Water, so as to swim on it, and yet to be more cohesive than it, as appears by these Instances, namely, it rarefies by Heat sooner than Water, because being cohesive it does not suffer the Fire to pass freely through, but retains it, which elevates it, and because it ascends later than Water by Heat; it coheres more than Water, because it is more flexible and soon changes its spherical Figure, by any Pressure upon it, into a plainer, and consequently touches in more Points. These Properties of Oils do plainly shew us, that they retard the Circulation, and especially if we add to these their Power of relaxing the Fibres, we are put out of Doubt; since if the Fibres do lose their Elasticity and propelling Power, and the Fluids are sluggish, the Circulation will of Course be slow; the Effects of which are a Decay of natural Heat, and Obstructions, for the Blood will be render'd glutinous; and as Oil in Plants is their Glue, so it is ours also.

Fourthly, They are *globular* as to their Figure; the naked Eye discovers this Figure in Drops of Oil; and this proceeds from the Particles attracting each other according to their Distances: be this how it may, this Figure entitles Oils to destroy Worms, because these Creatures have at the End of each Ring a circular Hole, so that the upper Part of them is a Row of such Holes from their Heads down to their Tails, and these serve 'em as so many Passages to breathe out at; if then Oils destroy these Vermin, it happens from these Port-holes being bung'd up, and then they are choak'd.

Fifthly, We have sufficiently proved above, that common Oils, that is, Oils by Expression, do contain a good deal of an *Acid in their Composition,*

position, and that therefore they may in many Cases be prejudicial to Bodies; hence is it observ'd, that Oils are cautiously to be administer'd in Heart-burns, where their Acid extricates itself and vellicates the Membranes of the Stomach; from the same Reason are they observ'd to be hurtful if apply'd to carious Bones, because a Caries happens not without an Acidity corroding the Bone, and adding more of a Body that corrodes, is not judicious; Vomitings proceeding frequently from Acids of too eager a Texture stimulating the Coats of the Stomach, as appears by vomiting up Contents that will make Copper Vessels turn green, cannot be assisted by Oils, which contain so much of this Principle in them; Inflammations, especially of the Eyes and Testicles, are prejudiced by *principal Oils*, because Heat evaporates their aqueous Parts, and leaves the Oils very glutinous, by reason of the Acids in them, which adhering strongly to the Fibres, bungs up the Pores, and hinders Perspiration, and consequently Dissipation of the Humours, and this Mistake being generally attended with Suppuration, the Eyes would suffer extremely in that Supposition; as would the Testicles; which two are near akin to inward Inflammations, and we know it is a general Remark, that *inward Inflammations are not to be supplicated*, unless upon certain Occasions; as to the Thrush, they are reckon'd also prejudicial, both because they relax the Parts, and give too much Scope to the Enlargement of the Boundaries of the Eruptions, as because by their Acidity they join in with Humours which are already too sharp and corroding; and tho' we have remark'd above, that Oils are Balsamicks, yet this Assertion is to be taken in a restrictive Sense, - namely, as they

soften and obtund Acrimonies, they mollify our Fibres and sheath the Salts, but as they contain much Acid in them, they join in with the Acrimony in the Ulcer, and are prejudicial: Now if we receive equally Good and Harm by any Remedy, and we have no Method to prevent that Harm, Reason forbids the Use of such an one: Oils then, as they are circumstanced, are not to be used in Ulcers, unless we add somewhat to correct this ill Quality: Now as in distilling Gums or Oils, we add Lime, Bricks, Chalk, Bole, or some such Absorbents, to suck up the Acid, we call the Oils easier off, and rob 'em of their Acidity, so in the frequent Administration or Application of Oils, Physicians blend Crabs-Eyes, Pearl Powder, or even volatile Salts along with them, because so we hinder them from becoming corrosive, and preserve them from turning too glutinous. True Balsamicks are Oils join'd to a certain Proportion of volatile Salts, and therefore Tincture of Amber is reputed one of the best internal Balsamicks in Nature, we call it *Lac Philosophorum* when it is dropp'd into Water, because it makes the Water milky; for the oily, or rather, its resinous Particles obtund the Acrimony in the Ulcer, whilst its Salts, being neutral, irritate and contract the Orifices of the Parts: but we shall speak of this elsewhere more at large.

Sixthly, The component Particles of Oils are *repellent* with regard to Water; for Water and Oil do not blend together alone; there is an unregarded Intemperies, which, however, I have met with in my Practice, namely, we see the oily Parts swim on the Serum as plainly as we do Oil upon Water; the one of these I remember labour'd under a Jaundice, and the Obstruc-

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tion of the Gall-bladder appear'd to depend upon coagulated Choler sticking to the *Ductus Chole-dochus*, and bunging up the Passage; what makes this Sentiment certain, was, the Discharge of this Substance, exactly resembling Castile Soap, by the Administration of Oils required for a Cough, and the quick Disappearance of the Jaundice after its Excretion; in the Blood drawn from this Person inflammable Oil swam upon the Serum of a very deep yellow Colour, which soon went off by the Pores, and the Urine especially, upon the Removal of the Jaundice. Few can disagree, that Pus or Matter in Ulcers is very oleous, it settles even in Urine or Salt Water, and this happens altho' it gives a Green to Syrup of Violets, for the Salts in regard to the Oils are too few, to cause it to blend with the Blood when it is resorb'd into the Vessels, and gives thereby a Fever Fit; in short, it appears to be a pitchy Matter, and very acrimonious. These few Instances give us sufficient Hints to confirm us in the repulsive Faculty of Oil, and that in our Vessels too, and as there are Methods in use without our Bodies to blend Oils with watry Liquors, so is it reasonable for us to insist on the same Methods, if we suspect this Case in our Blood; For this End, when Persons are afflicted with inward Ulcers, and the Retreat of this ulcerous Matter into the Vessels creates Fever Fits, Physicians have found beneficial hitherto Antimonials, Antihecticum Poterii, Vulnerary Decoctions, and more especially the Peruvian Bark; but these are administer'd without any other Design than to drive this Matter out of the Vessels, which Nature itself, by Irritation of the Pus, regularly attempts after a Struggle made within us: The Question I put is, whether this Matter

might not be render'd harmless by very easy Means; for as the Yolks of Eggs, or as volatile and fix'd Salts are known to cause Oils to blend with Water or watry Liquors; so it were worth while to try, if some such Mixture would not have the same Effect on *Matter* or Oil swimming in the Blood, and prevent or cure its ill Effects upon us. Altho' I have descended to these Particulars on this Head, yet I am not the only one, who believed that Particles not blending well with the Blood were the Cause of the Fits of intermitting Fevers; however, this may be true in general, we all acknowledge the Truth as to this last Particular.

Seventhly, Oils are *incompressible*, however they admit of Change in their *Consistence*; Oils, as all Principles, put into a compressing Vessel, do not suffer any Diminution in their Bulk; but by an Addition of Salts of various sorts, or of a similar Body, they grow thicker or thinner thereby, so that their Bulk will grow larger, and even may be rarefied, tho' they can't grow less by any Means save by taking away some Part of them.

N.B. The common Method of making Oils or oily Bodies *thin*, is done by mixing the oily Materials with fix'd or volatile Salts, or with the Yolk of an Egg; thus Turpentine may be thinn'd by the Yolk of an Egg, and then it mixes readily with any Decoction of Water, and serves for Glisters, or Oil of Almonds may be mix'd with any watry Menstruum and be made into an Emulsion by the Assistance of the Yolk of an Egg; and Resins themselves may be so nicely prepared as to blend readily with Water; for Example, if we powder any Resin (of Jalap, or other) and add to it the Yolk of an Egg, and if we by the help of a little Fire reduce this

Mixture,

Mixture into a sort of Extract, this Extract will at any time hereafter be very readily dissolved in Waters, and serve as a Purgative: It is daily remark'd, how readily all Soaps are dissolved in watry Liquors, which we know to be Compositions of Oils and fix'd Salts evaporated to the Consistence of Extracts of various Consistencies. It does not answer my present Purpose to descend to the Particulars of making the different Sorts of saponaceous Extracts, it is sufficient to us, that we know alcaline Bodies do attenuate Oils, and that all Oils so managed will blend with Water; one Thing I shall remark to you, that if the Oil be an æthereal one, the fix'd Salt will lick up thrice its Weight before it becomes a Soap; and this is observable in making the *Sapo Tartareus*, (which distill'd affords a volatile Salt, as does all Soap) for the *Pilulae Matthæi*, where thrice the Quantity of Oil of Turpentine is required to one of the fix'd Salt. There are indeed other Methods of attenuating Oils, that is, by Insolation, Digestion, Precipitation, and Immutation, namely, by exposing Oils to the Sun by a gentle Warmth, by adding certain Salts, and by adding Chalk, Calx of Lead, Lapis Callaminaris, and such like; but as these may well enough be referr'd to some of the former, we shall drop this Question: Agitation alone will make Oils thin; Agitation moves the Body, Motion heats it, and Heat attenuates and divides Particles: It is observed, that Blood let out of a Vein will not coagulate, if it be blended with volatile or fix'd Salts, nay, if it be toss'd continually by a Spoon or Piece of Wood it will not congeal; the Activity of the Salts and Agitation of the Spoon have then the same Effects upon the Oils of our Blood. Whenever therefore our

Blood grows glutinous by Evaporation or Heat, or by an Addition of acid Salts or Cold, if by the former, Water warm'd a little supplies the Defect of that Part evaporated from the Blood, and renders the Oils thin again ; but if also acid Salts or sharp and cold Air have concurr'd, then alcalious Salts must be added to the Water to reattenuate it : This latter Part appears manifest to the Eye ; for if we have congeal'd the Serum by any acid Salts into a Jelly, by only adding a proportionable Quantity of alcalious Bodies, the Serum huffs and rises into Bubbles, but at last returns to its former Fluidity ; and the former appears by exposing the Water from a Blister in a Cup to the Air, it in process of Time turns into a Glue ; however, by adding to this Glue, as I did, Steel-waters in any Quantity, it dissolves and becomes of a thin Consistence again : I bring these Experiments on Serum and Blood, supposing no one will dispute with me, that the Blood and Serum contain Oils in them, which I shall amply prove in the Sequel of these Discourses : Oils by being render'd thicker, are then also made more cohesive ; this cohesive or adhesive Quality consists in a certain Degree of Flexibility and Amplitude, as well as in an Inequality of Surface in the component Parts, they therefore fall more easily into Contacts, and stick readily to every Body that they meet with ; the more the Water is evaporated, the more do the Oils cohere, and even in this Manner they will prevent the Entrance of the Air ; for Oils half evaporated become butyraceous, and do then best preserve Arms from rusting ; and the more cohesive Oils are, the more Acid they generally contain in them, and do then also take Fire the quickest, and burn also the most fiercely ; hence

is the Fat of Weathers the most fit for Candles, and hence does it give us Cholicks so quickly, because it contains much Acid and but little Water.

Eighthly, *Oils do supply oily Parts*, where they are wanted, and as one Ingredient of the Blood is an Oil, that is, as Oil is one fourth Part or more of the whole, where-ever that is wanting, it ought to be supply'd ; this is the Case in *Atrophy's*, where the Solids are deprived of their due Flexility, and the Fluids of their due Consistence or Fluxility : Let no one possess us, that Materials void of Oil can be converted into this Principle in our Vessels, or that elemental Water, as such, can supply this Defect ; these are *Chimera's*, and have really no Foundation to support them. Can any Mortal be so *ingeniously ignorant*, as to endeavour at proving, by dark and weak Arguments, that *pure Water* will equally serve the Turn in supplying *Semen*, as Bodies stock'd richly with acrimonious and mucous Particles do, or that Element will equally recruit a *Syncope* with volatile oily Salts or rich Cordials ? All the Agitation the Fibres are capable of, cannot make Oil out of Water, unless the Water contain'd Oil in it, as it often does imperceptibly : This would be to assign a creating Power in our Solids ! 'Tis true, that if Oils are contain'd, they are by the Motion of the Solids express'd, and are variously changed, according to their Nature, that is, they are ultimately turn'd into volatile oily Salts, by the bare Digestion or Agitation of our Fibres : but to imagine, as *Thales* did, that one Element is the Original of all, we must deny our Senses and our Reason too.

Having treated enough of Oils and their various Properties in general, we now come to

recapitulate their Properties. Let us now give the Virtues of Oils under one View; and I must observe to you, that Oils do relax our Fibres and Passages, and dissolve Grumes (*a*), that they disengage Adhesions (*b*), obtund Acrimonies (*c*), obstruct the Canals (*d*), are Vermifuges (*e*), retard the Circulation (*f*), repel watry Bodies (*g*), do contain Acids in them (*h*), are of a globular Figure (*i*), are cohesive (*k*), are changeable in their Consistence (*l*), and do supply Oils to our Blood (*m*). These are their general Virtues; let us now descend to Particulars.

Linseed Oil is good in Cholicks (*c*), Coughs (*b c*), Consumptions (*c*), the Iliac Passion (*c*), Pleurisies (*b c*), Costiveness (*a b*), Pains of the Hæmorrhoids (*a c*), hard Tumours (*a*), Tumours to be suppurated (*a d*).

N.B. Mr. Boyle advises us to give rancid Oil of Linseed in *Vomica's*; in that Case we want Relaxation and Motion too; by these Effects they will imposthumate and break; but it ought to be given fresh drawn in all other Cafes.

N. B. If we would use it externally, we take off the Acid from it, by putting a hot Poker or Heater into it, till it ceases to hiss, taking care to hinder the Flame by stopping it up close, or by throwing Lime into it: Or if we throw in Powder of Bricks and distil it, it is robb'd of its Acid: We are well assured, that it contains an Acid, because it turns Copper green; Iron, red; Lead, white; Tin also, white; Silver, milky, when Water is pour'd on; but Gold it does not touch.

N. B. Artisans make a Varnish of it in the following Manner ; they boil the Oil, they throw in a Crum of Bread, and it ferments, and the watry Parts exhale ; they then throw in Chalk, or any Alcali ; as soon as the Powders are settled, they decant it clear ; the Oil being thus prepared, they put it on the Fire, and throw in Amber, Sandarach, &c. and this is a Varnish for Wood.

N. B. The Rancor is cured in the following Manner ; I have already observed how it is cured in general, but I shall here subjoin the particular Method : We wash the Oil often in clear Water, till a thick Water subsides, which we throw away ; then we boil it in Spirit of Wine, till the whole Spirit is wasted and consumed ; then it becomes sweet, loses its Rancor and unpleasant Smell, and may be given in Asthma's, Pleurisies, and other pectoral Cases with Sugar.

Oil of sweet Almonds, is good in nephritick Cases, while the Urine is pale (*b*), Pleurisies (*b c*), Cholicks (*c*), Expectoration stopp'd (*b*), Dysfuries (*c*), Costiveness (*a b*), strait Passages (*a*), rough and hard Skins externally (*a*), in acid Humours (*c*), Atrophies (*m*), Watchings in Emulsion (*a c f*), Dysenteries (*c*) ; but it is bad in Heartburns (*b*), Thrushes (*b*), Caries (*b*), Erysepelas (*b*).

N. B. If we design to use it externally, it is best to boil it.

N. B. Altho' the Acid in this Oil be not so copious as in most others, yet it sours soon in Emulsions, if kept in a hot Place, and then it turns

turns as mucilaginous as the White of an Egg : I have already shew'd how to make Oils into Emulsions, namely, by the Oil mix'd up with the Yolk of an Egg, and simple as well as other Waters blended with it.

Oil Olive, is good in Poisons from pointed Particles (*c*), pectoral Cases (*b*), Cholicks (*c*), Strangury (*c*), Gravel (*b a*) ; externally it is good in Atrophies (*a b*), rough Skins (*a*), Pains (*c*), Hardnesses (*a*), hard Fæces in Glisters (*a b*). But it is bad in Vomitings (*b a*), and Relaxations (*a*), and externally it is bad in Ulcers (*b*), sore Eyes (*d f*), and obstructed Pores (*d*).

N. B. This Oil is known to corrode Locks and metallick Vessels, therefore it contains an Acid.

N. B. Mr. Boyle observes, that it yields a butyraceous Substance.

N. B. If we give this Oil, always give Absorbents at the same Time.

Sperma Ceti, is good in After-pains (*a c*), Bruises (*a*), Gravel (*b*), Pleurisies (*b c*), Pains (*c*), pectoral Cases (*b*), Gripes of Children (*c*), Suffocations (*b*), Catarrhs (*c*), Lochia stopp'd (*a*), Milk curdled in the Breasts (*a*), Distempers of the Womb from Cold (*a*), rough Skins (*a*) ; and that it is bad in Memories lost (*a*).

N. B. As it mingles with Water by the Help of the Yolk of an Egg, it necessarily follows, that when it will not answer this End, it is sophistivated.

N. B.

N. B. It is counterfeited with Wax, but then this Cheat is discover'd by the Smell, and by its Opacity, for genuine *Sperma Ceti* is transparent.

N. B. If it be old, it grows rancid, and it should not be administer'd then, because it is nauseous.

N. B. It becomes so white as we see it by a Lixivium of Pot-ash and Lime.

N. B. It is a white, tender, oily, and almost transparent Substance, and of an animal Smell.

N. B. It comes from *Groenland* or from *Cape Finisterre*.

N. B. It is the Brain of a Species of Whale, melted over a gentle Fire, cast into Moulds; it is often melted, till it becomes pure, and then it is cut into Fleaks; or they strain it (first melted) thro' a Sieve, throw it into a strong Lixivium, it grows white, they stir it, strain it, and dry it in the Air.

Oil of Lilies, is good in Costiveness (*a b*), hard Tumours (*a*), Tumours to be supplicated (*a*).

Oil of Bricks, this is only Oil distill'd from Powder of Bricks, and Lime or Colcothar does the same thing, that is, they rob the Oil of its Acid, and render it thinner; it is us'd as an Emollient in hard Tumours (*a*).

Oil of Eggs, are good in Pits of the Small-Pox (*a*), rough Faces (*a*), Fissures (*a*), and Pains (*c*).

Butter, is nourishing (*m*), expectorant (*b*), and is good in the Stone (*b a*).

N. B.

N. B. If you mix any alkaline Salt, such as fix'd or volatile Salts, Soap-ashes, or even Sugar along with the Colostrum or Cream, no Butter will be got, because these Salts keep the Cream fluid ; but again, if you add any Acid in a sufficient Quantity, so as to conquer these alkaline Bodies, then you may get the Butter.

Fats, Marrow, Grease, are anodyne (*c*), soften Tumours (*a*), are lenient (*c*), and are used mostly outwardly.

Ointment of Marshmallows is good in Pains (*c*), Cramps (*a*), contracted Limbs (*a*), and hard Tumours (*a*).

Pectoral Ointment is good in Pains of the Breast from Coughing (*a*), in Pleurisies (*a c*). It is here necessary to observe, that some Oils or oily Bodies have remarkable Properties not retaining to the Effects of their principal Oil ; but because they are mostly oily, we shall take the Liberty to subjoin them.

Flowers of Brimstone are balsamick and pectoral, and obtund Acids, because they contain in them a large Proportion of Oil with regard to their Acid ; they purge in the Piles, that is, they keep the Belly soluble, and dry them ; for in Truth, Sulphur is a volatile oily Salt *in Power*, therefore do the Flowers open the obstructed Canals, and contract the Fibres in those soft and depending Parts, that they should not admit of too many Humours : I have been told, that a certain Gentleman much afflicted with the Piles did always receive Benefit by Brimstone, but rarely by its Flowers, and as the former only differs from the latter in having more Earth and Acid in it, so this proves, that the vitriolick

Part

Part of Sulphur acts forcibly in this Case : They are good in Itches, and especially the Sulphur itself, because the Oils do only disengage the Scabs from the Skin ; it is the Vitriol of the Sulphur that closes up the ouzing Orifices, and hinders their Eruption afresh.

N. B. They stop a Salivation from Mercury, as they fix Mercury in Cinnabar and Æthiops Mineral ; and one Dram or two given at proper Distances seldom fails of doing this Feat.

N. B. They fix volatile Salts by their Acid, and also corrode Metals by the same.

N. B. They readily mix with Oil of Turpentine, and make an excellent Balsam, as is well known, which will dissolve Quicksilver, so as to mix with Ointments.

N. B. The Inflammability of them, convinces us of their Oiliness.

N. B. Sulphur, even the antimonial Sulphur, is resolved into a saline, earthy, and a bituminous Substance, as may be seen in making Balsam of Sulphur.

N. B. Its Composition is also shew'd to be Oil, Earth, and Acid, because Oil of Turpentine, and Oil of Vitriol distill'd afford a Brimstone.

N. B. Flowers of Brimstone distill'd from calcined Vitriol are corrosive, because the Oil is only then call'd over instead of the Spirit.

N. B. Its Steams whiten fresh Rose-Buds.

N. B.

N.B. Any acid Spirit precipitates Sulphur white.

N.B. Sulphur makes Silver of a blackish brown Colour.

N.B. Sulphur is known to be contain'd in Bodies, because set Fire to, it gives a blue Flame.

N.B. Add a little common Sulphur to Plasters, and it blackens them; and Sulphur apply'd to Ulcers, turns them black: hence do some Surgeons dress with Sulphur in Ointments, to feign a Gangrene and frighten.

N.B. Sulphur with Salt-petre or Salt Armo-niack or Tartar inflames and detonates.

N.B. Roman Vitriol is render'd green by Sulphur, but it is observed to blacken all other sorts of Vitriol.

Milk of Brimstone, which is Sulphur dissolved in Water by the Assistance of Water and Salt of Tartar, and precipitated by Spirit of Vinegar: It is used in pectoral Cases, and in the Piles, because it lubricates and makes the Phlegm flip up, and because it obtunds Acrimonies: 'Tis stronger than the Flowers of Brimstone, and yet does not heat so much as they.

Castile Soap is good in the Gravel and Jaundice; in the first, because it lubricates the Passages, and in the latter, because it opens Obstructions and lubricates.

N.B. All Soaps are a Composition of Oils and fix'd Salts variously managed.

N.B.

N. B. The green and red are made by adding red Oker of Copperas and Colcothar boil'd in it.

Cinnabar is good in Pains, from the Sulphur; Convulsions, from the Mercury; Acidities, from the Mercury; Epilepsies, from the Sulphur and Mercury; Rheumatisms, because it opens, attenuates, and obtunds; and the Lues, because it obtunds Acids.

N. B. 'Tis Mercury fix'd by the Acid of the Sulphur.

N. B. In powdering Cinnabar Alcali's, as Oil of Tartar, if a small Quantity be added, do heighten the Colour; but if too much be added, it makes it yellow; and if we add Acids, they darken it; thus managed, Printers make their red Letters brighter.

N. B. Cinnabar of Antimony, which is much used, smells sulphureous.

Aethiops Mineral is good in Worms, in the Grand Pox, in a Sarcoma of the Testes, if given to a Dram at a Time; for Worms bear no Vitriolicks, and Mercury turns such within us; in the Pox, because it sheathes and corrects the Acids; in a Sarcoma, because it opens and dissolves.

N. B. If you view it in a Microscope, the mercurial Particles appear in Globules.

To sum up therefore the Properties of Oils, and their Virtues, deducible from thence, I say, that

that Bodies which have the following Properties
are call'd Oils or the *oily Principle*.

1. Oils are flexible and soft.
2. They are changeable.
3. They are porous.
4. They are heterogeneous.
5. They are light.
6. They are cohesive.
7. They are repelling.
8. They are incompressible.
9. They supply oily Parts.





P R A ELECTION II.

O F T H E

PRINCIPLES *called CHYMICAL.*

II. On ACIDS.

THIS Description of Acids by the Antients approaches very near to what our Moderns have observed, or discovered, for they call'd such Bodies as tasted sour to our Palate, *καρπίδη*, *καρπύλα*, *λεπτά*, *ἀπεριφερῆ*, that is, they supposed them to be of a *Conical* Figure, because they found them pungent, and piercing; of a *Crooked Make*, because they found them to produce a lasting Effect, and consequently they imagined that they were of such a Figure as would stick to the Organ of Taste, and this Conjecture holds, as Microscopes inform us on a like Occasion, because to stick to any Part requires a certain Structure for that End, so Flies and other Insects that stick to

Ceilings, are observed to have a Structure suitable for Adhesion ; they described them *small*, to such a Degree as was suitable for Entrance into the minutest Pores, which they were to pass by, or thro' the Interstices of the Vessels thro' which they are to be carried ; lastly, they said they were *not circular*, for then they would fill up a Vacancy and lurk in any Corner, and yet not stimulate, so that they would serve to hinder the Actions of Fibres without giving any Sensation.

Thus may we see how industrious the Fathers of Physick have been to find out the Nature of things, but they being led on by a false Philosophy, and being depriv'd of the Happiness of our late Discoveries, could not, in most Affairs of this kind, act otherwise than by Conjecture, and so were obliged to leave us Hypotheses in lieu of Facts.

However if we descend to the modern Description of Acids, we don't find a very great Addition made to the foregoing Particulars ; for we now say, they are *elliptical, acuminated Bodies*, that they are *conical, hard, attractive, heavy, fixed,* and *moveable* in their Nature ; our Microscopes discover their Points ; and the Touch, especially if applied to a Wound, or to so tender a Part as the White of the Eye, betrays their Sharpness of Figure. 'Tis from these pointed Bodies that all other Salts whatever take their Origin, and their Effects also are owing to these Points, so far as they act by Stimulation ; they are specifically heavier than all other Salts whatever, and have a greater attractive Force in them, and this Weight, added to their Figure, makes them to require a greater Force and Impulse of Fire to cause them to mount up than others ; and whenever any Acid requires a greater Degree of Impulse to rise up, than another of the same Species, that is

is the strongest which demands the greatest Force, and that must of course be the heaviest and most active also : for as strong Acids hold in their Pores a great deal of Fire, the more any requires to make it rise, the more Fire does it hold.

This leads me naturally to enquire into the Species of Acids, where, upon a mature Deliberation, we shall find two Sorts, namely, *Natural Acids*, and *Artificial Ones*. By the *Natural*, I understand such as are afforded us without the Assistance of the Fire, or, at least, such as are afforded us with a gentle Heat ; and by the *Artificial*, I mean all such Acids as are made and separated by the Force of the Fire ; not that there is any Difference worth observing as to the *Sincere Acid*, in either the Natural or Artificial, but that the natural cannot be had pure without the Help of the Fire, and that when we have once reduced any Acid to be pure, it must then according to its Pores, contain also more or less of Fire.

The Natural Acids are better known by setting them down, than describing them, and such are Lemons, Oranges, Sorrel, Tamarinds, Barberries, Verjuice, and such like, all these are very distant from a pure Acid, because to them adhere Earth, Water, and Oil, if not some factitious and compound Particles ; for Example, Tartar is an essential Salt, or a natural Salt made by a small Heat, and it is plainly a compounded Body, because the Nature of all Salts whatever is to be soluble in Water, now Tartar is with Difficulty dissolv'd in the softest warm Water, because there is so strong an Adhesion between the Acid of the Tartar and its Earth, that their Attraction is not conquer'd by the Water, but as soon as we add a little Salt of Tartar to the Salt, these two Salts attract one another so strongly, that the Earth subsides, and the Water being a proper Menstruum for Salts,

the Dissolution becomes easy; hence the *Tartarus solubilis* readily dissolves, whilst Crystals would remain undissolv'd at the Bottom, and in the same Manner a small Quantity of Salt of Tartar, mix'd with Cream of Tartar, causes the Cream to dissolve readily, which otherwise subsides.

All *Essential Salts* are principally Acids, and partly Earth; they are made by boiling the Plant in Water to the Consistency of a Syrup, then you set the Liquor in a cool Cellar to crystallize, and thence a *Tartar* is got; or you bruise the Plant or Berries, &c. you express their Juice, you filtre, exhale, insipiate, and place the Matter in a Cellar for some Months; we gain from Bitters and mucilaginous Plants, a Nitrous Salt, from Acids, Austeres, and Astringents, a Rhenish Tartar, and we gain Tartars principally from these Plants, as appears in their Extracts, all which soon taste acid and sour; but from Aromatick Plants, none at all, they containing volatile oily Salts.

No oily or volatile Plants can afford any essential Salt, and the others are either Acid and Earth, or Acid and fix'd Salt blended together.

Wines afford Tartar, or an essential Salt, most plentifully, the *Rhenish* Tartar is white, the *Lisbon* brown, the Red Wine Tartar is red, the *Canary*, being an oily Wine, affords very little: If these Tartars were not stony, as appears by their Grittiness, they would be dissolv'd in their own Wines at least.

If we examine these Tartars by analysing them, they give out an acid Water, an Oil or Spirit, an acid Spirit, a fix'd Oil, a fix'd Salt, and an Earth

It were easy to know that an Acid is the prevailing Principle in these essential Salts, because Tartar makes Brals into Verdigrease, and all essential Salts have the same Effect, and so it falls out with

with artificial Crystals of Metals, which are a factitious essential Salt.

So far for natural Acids; as for the artificial ones they are had only by the Force of the Fire; thus we obtain acid Spirits, which are acid Salts swimming in Water, and which, by the Fire, acquire a violent Motion; by this new additional Property, acid Spirits become very active, and are then reckon'd a moving Principle; their Activity depending on their Motion, their Figure, and their Weight.

The artificial Acids therefore contain a good deal of the Element of Fire in them, whilst the natural have little or nothing at all; neither do the natural contain much Air in them, because they are observ'd to hinder its Production, as the ingenious Mr. Boyle has told us; for Vinegar, Cold, and any other Acid hinders Fermentation, which produces Air, and strong Beer is observ'd to be less windy than Ale; the Particles of natural Acids cohere strongly together, they admit of Separation with Difficulty, and they stick together more strongly than the Particles of human Blood, whereas the artificial Acids move Bodies strongly, they cut and tear even the Bones themselves to Powder. Reduce then artificial Acids to natural ones, or, *vice versa*, bring natural Acids to artificial ones, and their Effects will be univocal; this Reduction depends upon Dilution and Obtusion in the former, and Analyfis or Concentration in the latter.

So that whilst we consider these two States of Acids, we take two Views of one and the same Matter, which however cause an infinite Difference in the Virtues of them, for as Remedies differ according to the mechanical Properties they enjoy, it necessarily follows, that the Virtues attend their Alterations; and a minute Difference easily betrays

itself in the Effects. This may perhaps be objected against me, who am aiming at a nice *Rationale*, that I am an Encourager of Empiricism; but far be it from me to act against Experience; where one Remedy is found constantly to produce Effects, which another of the same Species does not; must I not suppose that some of their mechanical Properties differ? My Busines is not to contradict this constant and stable Experience, but to find out the true Reason why there is this Difference; *Aqua Fortis* and *Aqua Regia* are both strong Acids, and, as to our Bodies, they do ever produce the same Effects, yet in the Dissolution of Metals they differ plainly, the first not being able to dissolve Gold, nor the latter Silver: They, being two Bodies under the same Species, differ however in their Bulk and Figure, the *Aqua Regia* being smaller, and the *Aqua Fortis* larger, they fit the Pores of each Metal better.

Having thus taken a general Survey of Acids, I come next to consider how far they are to be reputed a *Principle*; In order to which, I affirm that Acids, when they are pure, are constituent and component Bodies, and are then Principles in such Sense, as I take them.

They are hard and not liquid, and therefore Acids that appear in a liquid Form, are Acids swimming, or an essental Salt dissolv'd in Water: Thus Oil of Vitriol, which is eminently acid, becomes hard by an Exhalation of the watry Parts of it, whether by Fire or long keeping, and all these Salts do, in like Manner, become Crystals, extremely caustick and penetrating, whenever the Liquor is exhaled.

These Salts are contained naturally in Bodies, but all others, such as fix'd or volatile, are factitious, namely, are made either by the Fire or by Digestion,

Digestion, that is, there is made an Union by various Motions, Attractions, Combinations, and strict Adhesion of some Parts to others, which by Friction and Attrition receive a determinate Shape and new Properties ; but however, these acid Salts are the Basis of them all, for they being differently combined, shaped, and framed, give other Properties, of which in their proper Places.

For Acids to be reputed a Principle, they must, I say, be pure and homogeneal, that is, nothing must adhere to them which is not Acid, or they must be void of Earth, of Oil, and Water, or any extraneous Body adhering to them. As for Tartar and other Crystals, we don't pretend to call them *pure Acids*.

It is not an easy Matter to make Acids homogeneal, it is sufficient for our Use that they are *nearly* so ; Art is deficient in this nice Affair, however we come so near to a Purity, that Experience and Experiments inform us of the rest. Experiments are a nicer *Criterion* than *Analysis*, but Experience is the nicest of all. Now when I talk of Experience, I don't understand any Man's greater Approbation of one Remedy than another ; for that is too often an Effect of Caprice and Humour, but I speak of the constant Difference observable between one Remedy and another of the same Species, which, repeated Trials, and the common Consent of Mankind, must concur in, before it be allow'd of : If, for Example, we use Spirit of Sal Armoniac made with Salt of Tartar, or that made with Lime, there is a wide Difference between them, the latter being unfit for inward use, but these are the same Spirit, the Effects of which are diversified by the Ingredients they are made with ; the latter therefore becomes more concentrated, because its Particles are too rigid and

pointed : The same Difference holds in the acid Salts we are speaking of, the more homogeneal they are, the stronger are they.

However difficult it is to make Acids pure, we shall give our Hearers several Methods of reducing them to a Homogeneity ; observe then the various Directions on this Point of Concentration, which is attempted four several Ways ; namely, by Distillation, and Rectification, by Cold, by a Mixture with fix'd and other Salts or Earths, or rectified Spirit of Wine, and by a Mixture with contrary acid Salts, of all which in proper Order.

We bring Bodies to be pure by calling them over the Helm twice or thrice, because the Fire separates some Parts from others, and they rise in their proper order according to their Gravities ; thus, in distilling Plants, the Water rises first, then follows an Acid blended with Water, thirdly mounts a light Oil, next to that we get a heavy Acid, and lastly the pitchy Oil, and the Earth and fix'd Salts remain at the Bottom. In the Distillation of Sea-Water, the Water rises first, and then follows the light Acid along with Water : The lighter Parts therefore of Acids are elevated into the Air, from the Surface of the Earth, and from our Vegetables by the Heat of the Sun, for a small Heat causes the Water to fly up, and along with it are carried the gentle Acids, as you have seen in the Analysis of a Plant, and of any other Body containing an Acid ; this I have shew'd in Tartar distill'd, the same holds in the Distillation of Wax, where a gentle Warmth exhales the Water, and this Heat a little augmented carries up some Acids.

The Acid that mounts with so gentle a Heat, is only a Part of this Salt, which is intimately dissolved in the Water, and whose Minuteness causes it to yield to any the least Impulse ; Bodies reduced

reduced into minute Particles, acquire larger Surfaces, and Resistance encreasing with the Surface, they are suspended in a lighter *Medium*, and being united with it, any Impulse carries all up together: All Acids in their own Nature are heavier Bodies than Water, and were they not detach'd from their larger Bulk, they would not mount so readily.

This detach'd Part of the Acid is the *Gas* of acid Bodies, which flies off upon a small Heat; it may therefore be called the Volatile Acid, and it gives a Pertness to Liquors; for Instance, in making Vinegar, if you suffer it to evaporate too much by the Heat of the Sun, it becomes pall'd, and good for little; we experience the same in Lemons and Oranges, which, whilst they are fresh, are of a lively and pert sour Taste, but if they are kept too warm, they taste pall'd and dead: In the Distillation of Elder-Berries the light Spirit or the spirituous Water soon ascends, as in the Distillation of Vitriol, a gentle Heat obtains the Spirit.

All these Examples serve to confirm us, that Fire is one Method of separating Bodies, and consequently, of coming at pure and unmix'd Principles; not that I suppose this *Gas* is a Principle, for I have avowedly shewn you that it is a Mixture of two, namely, of Water and Acid, and if we are inclin'd to have a pure Acid, we must rectify, as has been intimated on that Head, to come at the pure Principle; so in Vitriol, Allum, Nitre, and others, the strong and pure Acid is got last, and therefore we suffer their Phlegm and Gas first to evaporate, if we aim at the homogeneal Spirit.

The most accurate Way of gaining these Spirits pure, is by pouring them once or twice upon any fix'd Salt, or their Caput Mortuum, or any Metal

or

or Metalick Body, evaporating the aqueous Parts by a gentle Heat, and by distilling them till they come up in the Form of a Salt, namely, dry, and then they are as strong as Fire itself, and will consume Bodies as fast as Fire. Thus if to calcin'd Flints you pour on Spirit of Salt and distil, you gain a strong Spirit of Salt from this alcaline Body, for these two mix'd become salso-acid.

In the next Place, a freezing Cold gives us pure Principles, so if we expose an acid Body, dissolv'd in Water, to the Air, the Water freezes, and leaves us this Acid at Bottom, but this Method cannot be esteemed properly accurate and nice for acquiring a pure Body, because we have not always an Opportunity of having it, unless by a freezing Mixture, and then somewhat still remains that will not freeze, in which the Acid swims; and we aim at an exact Purity: This Method indeed is strong and forcible enough to gain Brandy from Beer or Wine, but we require a much greater Nicety for a principal Body.

A third Method is by mixing some earthy Body, or some fixed Salt with Acids, and then, as soon as they have done with their huffing, we evaporate to a Drynes, and give a strong Fire, the fix'd Salt remains at the Bottom, and the Acid is forced up into the Retort, pure and unmix'd: This is the nicest Method of obtaining a pure Acid, because the fixed Salt will not mount, the watry Parts readily exhale, and nothing but a pure Acid ascends: Thus we discover how much each acid Spirit falls short of being pure, to a great Accuracy.

For Example, we gain a concentrated Spirit or Oil of Salt, by pouring Spirit of Salt upon Powder of *Lapis Calaminaris*, gently simmering the Mixture to make the Spirit enter the Powder, then we evaporate to a Drynel's, then we put this Powder into a Re-

a Retort, and make use of an open Fire, and call up the Spirit, and thus we gain a most strong Oil of Salt.

Or, we gain a strong Spirit of Nitre, Vitriol, or Salt, or Sulphur, by pouring any of these Spirits upon a fix'd Salt, they are then called *Nitrum nitratum*, *Nitrum vitriolatum*, or *Sal salitum*, or *Nitrum sulphuratum*, or *Tartarus vitriolatus*, and so forth; we suffer them to boil, and then we evaporate to a Dryness, and distil off the acid Spirit, which we obtain pure and homogeneal.

Or we take Verdigrease, which is Brads corroded by Vinegar into a Vitriol, and dried into a Mass, we powder it, and make Use of a strong Fire, and call over a concentrated Spirit of Vinegar, called *Alkabest Zwelferi*, or *Aqua mirabilis Mindereri*.

Nay, Evaporation alone will often serve the turn, as appears in the Spirit of Amber, which, if evaporated to a Pellicule, and placed in a cool Cellar for ten Days, we find the Acid turn'd into Crystals; and thus Spirit of Salt may be converted into a Salt by Evaporation: for it is a certain Truth that acid Syrups can be made stronger by Evaporation.

There remains a Doubt whether Evaporation does not carry off some of the acid Parts; but I say that we have many plain Proofs that it does not, for if you distil by a gentle Fire *Salt of Coral*, which is a Mixture of Coral and distill'd Vinegar, a Water only is obtained, which is insipid; or if you distil *Tartarus acetosus*, which is a Mixture of Salt of Tartar and distill'd Vinegar, by a gentle Heat, the Liquor obtained is without Taste, and is nothing but Water: In like Manner, *Tartarus vitriolatus* evaporated or gently distill'd, affords a tasteless Water; so if you pour Spirit of Nitre upon Quicksilver, Copper, Silver, or on any other Metal or Earth it can dissolve, and if you exhale,

the

the Liquor so evaporated is a tasteless Water; also if you pour the acid Spirit of *Guaiacum*, or Wax, or any other upon Chalk, and evaporate gently, what you evaporate being receiv'd, is an insipid Water; ; and if you hold a lighted Candle over Oil of Vitriol and Salt of Tartar whilst they are huffing and boiling, the same will extinguish it without crackling, which demonstrates that the Cause of this Effect is not any Salt but Water: I look upon these Instances to be sufficient to convince us, that what is evaporated is not Acid, but pure Water.

If indeed you pour Vinegar upon Chalk, and distil with a Heat greater than what would serve to evaporate, you then obtain somewhat of an Acid, as has been already observed; so Sea-Water by Evaporation affords Water only, but by a Heat equal to that in Summer, we obtain an acid Water.

The Art then is how to evaporate without giving any Motion to the disentangled Acid, for then we leave the whole Spirit behind, lodg'd in the Earths, Metals, or Salts.

By this Method we can very accurately tell how much of an Acid there is in any acid Spirit, for Example, you pour on the acid Spirit to Salt of Tartar, exactly knowing the Quantity of each, then you evaporate all the Water to a Drynes, and weigh again, what remains is Salt of Tartar and acid Spirit, subtract the Weight of the Salt of Tartar, Earth, or Metal, and you have the Quantity of acid Spirit obtainable by Distillation in an open Fire.

Thus it has been found, as before, that in one Cunce, two Drams and a half and six Grains of Spirit of Nitre, there are only three Drams and ten Grains of Acid; that in two Ounces and five Drams of Spirit of Salt, there are only three Drams of

of Acid; that in one Ounce and five Drams of *Aqua Fortis*, there are only three Drams and a half and six Grains of Acid; that in five Drams of Oil of Vitriol, there are only three Drams and five Grains of Acid; that in two Ounces and five Drams of *Aqua Regia*, there are only six Drams of Acid; and that in one Ounce of Spirit of Vinegar, there are only eighteen Grains of Acid contained.

From whence it follows that *Aqua Regia* has twice as much Acid in it as Spirit of Salt, because in twenty-one Drams, it contains six Drams of Acid, whereas Spirit of Salt, in the same Quantity, contains only a seventh Part of Acid, for $21 : 3 :: 7 : 1$, therefore in seven Ounces of Spirit of Salt, if we evaporate six of them, the seventh Part will be the Acid in Crystals.

But Earths, Metals, or fixed Salts are not the only Method of obtaining pure Acids, for if you put common Salt to Vinegar and distil, you gain a strong Spirit of Vinegar, that is, if you add one Part of common Salt to four Parts of Vinegar, you gain a very sharp Spirit, because Salt is attracted to, or dissolved by Water, and the Water being dissolved, there is nothing to mount besides the Spirit.

There is another Method of gaining pure Acids by rectified Spirit of Wine, for, if distilled, you have Crystals at Bottom, which are a pure and unmix'd Acid; thus if you digest Spirit of Nitre in rectified Spirit of Wine, so as to make *Spiritus Nitri dulcis*, if you distil this dulcified Spirit, the Spirit of Nitre turns into Crystals at Bottom, the Spirit of Wine and Water mounting up.

Lastly, we often concenter Acids by Acids, for Example, we mix Oil of Vitriol and Spirit of Salt, or common Salt together, and with a gentle Heat the Oil mounts up pure.

Thus

Thus have I briefly shewed you the Methods found out to make Acids pure and unmixed, or homogeneal and principial, the Design of which is to prove that Acid is one of the first, or ultimate, or component and constituent Parts, or a *Principle*, out of which other Bodies are made ; as to the mechanical Texture of Acids, I refer you to the Description I have already given you of them, at the Beginning of this Lecture.

Hitherto I have proved by *Analysis* that Acid is a *Principle*, and shewed how, by that Method, it may be obtained pure and unmixed, I shall, in the next Place, demonstrate to you by *Synthesis* or *Composition*, how Acids are contained naturally in Bodies, and how they may be discovered when they are contained in them.

That an Acid does naturally reside in Bodies, is evident from the following Examples ; First, it appears that an Acid swims in the Air, because Iron turns into a red Rust, and Brass into a Verdigrase, if exposed ; because Ink if it stands long exposed to the Air, becomes pale and useless, and if Papers are written and exposed for some Time in a cold Air, they become illegible ; again if you expose *Sal martis* to the Air, it runs ; in like manner, fixed and volatile Salts exposed, become from saline salso-acids, or acido-salines, according to the Time they are exposed ; so *Mercurius dulcis* becomes corrosive if it be much exposed, and Diaphoretick Antimony becomes again Emetick by being laid in the open Air ; in the same manner, Butter of Antimony, which is a gross *Maymec*, flows in the Air and becomes thin ; it is a known Experiment that if Allum, Vitriol, or any other Salt be robbed of their acid Spirit by Distillation, by exposing them for some Time to the open Air, you may again get by Distillation more acid Spirit from them ; if you expose Jellies,

they

they grow thin ; Cloaths by the Air lose their Colours ; the Countrymen have found by Experience, that if their Lands grow poor and lose their Fertility, if they tear them up and let them lie open to the Air for some Time, they will recover their Richness, and may be sown again ; it is handed down to us by good Authorities, that Ulcers of the Feet are very difficult to be cured in *Rome*, also Pewter, if exposed for any time to a cold Air, grows rough and black, and the Halonitre upon Lime Walls plainly proves it.

From all these Experiments it is lawful to conclude that there is an Acid in the Air, for these *Phænomena* are only producible by Acids, and moreover it would appear by some of these Experiments, that the Acid of the Air is a Spirit of Nitre or Salt, because it precipitates Salt of Steel, destroys Colours, and weakens, and even obliterates Ink.

The acid Spirits obtainable from Minerals prove there is an Acid in them, Emulsions growing sour as well as Extracts, prove it to reside in Vegetables ; and Butter-milk shews it to have a Being in Animals ; but of this more when we come to treat of an acid State in the *Practical Lectures*.

Having evidently proved the Existence of an Acid in all the three Kingdoms, it remains to give you some *Criteria*, whereby to discover it in Bodies, which I shall now proceed to.

First, they make Vitriols of various Kinds, they make Iron red, and turn it into a Rust, or however they give it some dead Colour, and for this Reason we find true oriental *Bezoar* gives to a Mortar of Iron and its Pestle, a blackish Colour ; they turn Lead, Tin, Silver, and Quick-silver into white Vitriols ; they turn Gold into a yellow Vitriol ; and they give a Green Colour to Brass, called Verdigrease, and even Tartar itself, as I have said

said above, turns Brass green ; this last calls to my Mind a Quarrel, where a Gentleman, whose Face was spit upon, was relating the Story to a Physician, and said his Adversary's Spittle was so virulent that it turned Green upon his Face ; the Physician returned this quick Answer, Because, Sir, he spit upon Brass : Hence may it be concluded that Spirit of Salt armoniac is not intirely void of an Acid, since it turns Copper into a *greenish* Blue, of which more among fixed and volatile Salts ; for Salts purely alcaline turn it into a Blue ; thence we readily understand why Waters distilled from Vegetables in a Copper Still become emetick, and why they turn the Still Green ; for as the Vegetable contains an Acid in it, it turns the Copper into Verdigrease, and Verdigrease is so strong a Vitriol that it will vomit and kill Worms : hence are Tartar and its Crystals Acid, because they give Brass a green Colour.

Secondly, they make Water in which red Flowers have been infused, red ; thus if you infuse Red Rose Leaves in warm Water, and pour some Drops of Spirit of Vitriol among them, there is presently made a Tincture of Roses : nor is this true only in Flowers, but also in Woods ; for if you take red Saunders and infuse it in warm Water, by pouring in Spirit of Vitriol, you gain a Tincture of Saunders ; in like manner, if you take Brasil Wood and boil it in Vinegar, it becomes a Red Tincture, and with Gum arabick and Allum, strong red Ink ; thus Scarlet is made of Cochineal in Water, and Spirit of Nitre in a Tin Vessel, that is, the Vitriol or *Salt* of Tin and Cochineal boiled in Water give a Scarlet Dye, and there is no Wonder that Vitriols should dye, because it will appear to be constantly so in all Dyes whatever, as has appeared when I spake of Dyes in the Lecture of Oils.

Thirdly,

Thirdly, They destroy the blue Tincture of *Lignum Nepriticum* boil'd in Water; for you must know, if you boil this Wood in Water, by *Refraction*, or with your Face to the Light, it appears yellow, but by *Reflection*, or your Back to the Light, the Tincture in the Glass appears blue; now Acids destroy this Blue by Reflection.

Fourthly, They make blue Flowers or their Juices red; thus if you infuse Violets, or Flowers of *Iris* in Water, and pour any acid Spirit into them, the Water becomes red; and this is a common Method of trying Acids, we pour the Body we suspect to be Acid into Syrup of Violets, and if it be a real Acid, it turns the Syrup red: This is not only true in Iris and Violets, but in all blue Flowers whatever, and thus the Infusion of *Dutch Turnsole*, call'd *Heliotropium*, *Scorpioides*, *Verrucaria*, or *Tricoccon*, will turn red with rectified Spirit of Wine, or any other Body that is Acid; and blue Paper also will turn purple with Acids; and Salt Armoniac dissolv'd in Water, and digested with Turnsole, turns blue Paper into purple: Hence is the Poison of Vipers reputed an Acid, because it turns Syrup of Violets, or Juice, or Infusion of Turnsole red.

Fifthly, Acids dissolve Coral; so Spirit of Guaiacum, which is a mild and gentle Acid, dissolves Pearl, and the same is done by distill'd Vinegar: Antimony, Lead, Tin, and Soot, also are dissolv'd by them. It is for this Reason that Oil of Aniseeds dissolves Coral, because we find by Distillation, that this Oil contains a good deal of Acid, that dissolves Coral: Chalk huffs with any Acid; Mercury with Spirit of Nitre; and distill'd Vinegar huffs, but does not grow hot with Coral.

Sixthly, Acids effervesce, or are mov'd, if blended with volatile or fix'd Salts; so if Salt of Tartar be mix'd with Oil of Vitriol, or if the Spirit or Salt of Hartshorn be poured upon the Oil, or any Acids, there arises a Huffing or Commotion; or if Pot-Ashes be mix'd with Spirit of Vinegar, the same happens: In like manner, Salt of Tartar huffs with Cream of Tartar; and Acids coagulate, or rather, curdle with Oil of Tartar.

Seventhly, Acids fall into a Flame with volatile Oils; so Oil of Turpentine, and the smoaking Spirit of Nitre, fall into a strong Flame; and indeed, with Oils of Cinnamon, Cloves, Nutmeg, or any other chymical Oil.

Eighthly, They coagulate and precipitate Oils; thus Oil of Olives is coagulated by Vinegar, and more by acid Spirits, or Oil of Vitriol; and Spirit of Nitre precipitates Tincture of Benjamin: thus if you boil Sulphur with Salt of Tartar in Water, and you pour on Vinegar, or its Spirit, you gain a Precipitate call'd *Lac Sulphuris*, but this happens from a Property which the fix'd Salt has of dissolving Oils; and the Acid weakening the fix'd Salt, the Sulphur drops: Thus, if you boil the Scoriæ of Antimony, which are sulphureous, in Water, you gain the Sulphur *Antimonii Auratum*, by throwing in Spirit of Vinegar; and the Infusion of *Crocus metallorum*, which is an antimonial Sulphur and Mineral together, is corrected by Oil of Sulphur, which is done by a Conjunction of the Oil with Acid; and as Spots are Signs of some greasy or oily Matter, so we see that Butter-Milk takes greasy Spots out of Scarlet.

Ninthly, They precipitate Alcali's, and are precipitated by them: But when I speak of Precipitation, it is not understood that an Effervescence should

should always ensue ; for there are *tumultuous* and *silent* Precipitations, Examples of which I shall subjoin ; a *tumultuous Precipitation* ensues, when a strong Acid holds a Body with its Points ; so if Coral be dissolv'd in Spirit of Vitriol, then, by pouring on Oil of Tartar *per Deliquium*, the Coral is thrown down, and an Effervesce concomitates ; or if Spirit of Nitre or Vitriol turns Ink white, so that it becomes a Liquor, by adding Salt or Oil of Tartar, an Effervesce ensues, and the Liquor becomes atramentous again. A *silent Precipitation* happens when the Acid that holds the Body is weak, or weaken'd by Water, or some such intervening Liquor, or when the Points of the Acid are broken only, and not wholly dislodged : It must moreover be observ'd, that a Lactescence, or Milkiness, is a Subsidiary to Effervesce or Precipitation ; this silent Precipitation may be instanc'd in many Examples ; if Coral be dissolv'd in distill'd Vinegar, it is precipitated out of it by Oil of Tartar, without any great Commotion ; so Mercury sublimate is precipitated out of Water by volatile Spirits or Salts, by fix'd Salts, or Lime Water without any Tumult : In like manner, Sugar of Lead is precipitated out of Water, either with Salt or Oil of Tartar, and becomes Magistery of Lead, and this is done without any Effervesce at all ; *Roman*, *Cyprus*, or blue Vitriol rubb'd upon a Knife's Blade, being first moisten'd with Spittle, dies the Iron of a Copper Colour ; but neither the *Dantzick*, the *Hungarian*, nor the *English*, which are Green, have this Effect : The Reason of which is, because the latter Vitriols are Martial, and the Acid having attracted Iron already, attracts it no more ; but the former are Copper, and Iron attracts an Acid more strongly than Copper does, wherefore the Copper

is left on the Surface of the Iron Blade ; and this is truly a *silent Precipitation* : So *Borax* precipitates Mercury sublimate out of Water, without any Noise, Ebullition or Commotion. Now *Borax* is an alcalious Medicine, as will appear hereafter ; although it is true also, that if *Borax* be distill'd, it will afford an acid Spirit resembling Spirit of Alum ; but there will be a better Opportunity of explaining the Species of Salt that *Borax* retains to : In general, where-ever a Salt is neutral, there may be a Precipitation, but no Effervescence : And lastly, Claret becoming of a yellow Colour with Oil of Tartar, and turning red again with Spirit of Sulphur, plainly shews that Claret is red by the Force of an Acid contain'd ; and these Precipitations and Resorptions made without any Tumult, shew there is some weakening Body interposed. It is very manifest from these Sets of Experiments, that it is not always necessary that an Effervescence should evene to prove the Presence of an Acid contain'd, or to discover whether any Acid be in it ; but such a silent Precipitation is sufficient : If this were not true, Acids must effervesce with Syrup of Violets, with the Juice of Turnsole and Litmass when they turn them red, or with Galls in Water in the Precipitation of Vitriols in Water.

Tenthly, *There are some Acids that precipitate others by an individual Property*. Thus nitrous, vitriolick, and saline Medicines precipitate each other : Moreover, Oil or Spirit of Vitriol precipitate whatever is dissolv'd in Vinegar or its Spirit, and *vice versa* ; and although Spirit of * Amber be an acid Spirit, or an ‡ essential Salt or Crystal, yet it effervesces with Spirit of Salt. I know Dr. Grew, in endeavouring to account for this

* Act. Haffniens. Bartholin.

‡ Lemery Chym.

Phænomenon,

Phænomenon, says, that some of those Spirits contain a subalcalifate Salt in them, which is a probable Reason since this Conflict is usual between *Acids* and *Alcali's*: Let this be how it may, I shall content myself with entering upon a Detail on these Particulars, and by this Discovery shall account for a great Variety of Appearances worthy of Notice. Examples will clear up the Matter: Thus

Nitre is precipitated by Vitriol, by Sea Salt, by Spirit of Nitre, by Spirit of Salt, and *vice versa*.

Spirit of Nitre, *Spirit or Oil of Vitriol*, *Aqua-fortis*, are precipitated by Spirit of Salt. *Oil of Vitriol* effervesces with Water, because it is found that common Water does always contain Sea Salt in it; for proceeding upon this Principle, if we dissolve Silver in Spirit of Nitre, and throw a few Drops of this Dissolution into Water, the Silver drops to the Bottom in a grey Powder, because whatever Spirit of Nitre has dissolv'd, is precipitated by Sea-Salt: Whether there may not be Fire in Oil of Vitriol also, I will not dispute, nay, it appears that there is, because in Water distill'd from a cold Still, where no Salt can, or its Spirit be exhal'd, by pouring in Oil of Vitriol there immediately arises a Heat, and the fresher the Oil is, or the more lately it is distill'd, this Effect will be the greater, as it happens with Salt of Tartar newly calcin'd, which, by reason of the Fire it contains in its Pores, huffs like Lime newly burnt with Water.

If we put Salt, Salt-petre or Alum, Spirit of Salt, or Spirit of Nitre upon Oil of Vitriol, there arises presently an Effervescence, and

Fumes fly up into the Air, of a choaking Nature, as appears by their making us cough and breathe short, as also very corroding, because it makes Holes in our Linnen and Cloaths ; and this is an easy Method for distilling such acid Spirits, which cannot be obtained otherwife but by a continued and vehement Fire : This Instance shews the Contrariety there is between the Motions or mechanical Principles of these Bodies ; and there is mention made in *Hartman*, of Vitriol for the Cure of the *Elephantiasis*, which, if Experience confirms, it will seem as if this stubborn, and as yet, incurable Distemper, depended upon a Mixture of some of these corrosive Salts ; namely, of a Mixture of Spirits of Salt and Nitre together. Sure I am, that mercurial Vitriols have no Effect upon it, and I confess I have tried Vitriol in Substance against this Distemper, according to *Hartman's* Advice, with some Success; but as the Patient did not follow the Method closely, I can affirm nothing certain.

Hence whatsoever is dissolv'd in Spirit or Oil of Vitriol, will be precipitated by Fountain Water, because Water contains Salt in it.

Spirit of Salt mix'd with Oil of Vitriol, is said to dissolve Gold, that is, it makes *Aqua Regia*, which plainly shews, that the Fumes which fly off, serve to concentrate these Bodies to the Degree of entering the small Pores of Gold.

Spirit of Nitre, as I have already said, dissolves Silver, and it may be precipitated out of it by Oil of Vitriol ; hence the Criterion of Salts being in Water may be disputed, since Vitriols also will precipitate the Silver out of the Spirit of Nitre, but

but we have other Methods of discovering Vitriols; and if these Trials with Galls, for Example, don't answer, then may we affirm it to be Salt that throws down the Silver out of Spirit of Nitre.

Bismuth, Silver, Tin and Lead, are dissolv'd in Spirit of Nitre, and are thrown down in a Powder by common Salt, or Oil of Vitriol; and hence comes it to pass, that Butter of Antimony, (which is made with Regulus of Antimony and Mercury sublimate call'd over the Helm, the acid Salts which make the Sublimate, to wit, Vitriol and Nitre, fix upon the Oil of Antimony, and curdle it into Butter; that th's Butter, I say) by pouring it into Water, turns into a Powder, and subsides to the Bottom, for the Salt that is in the Water joins in with, or fixes on Nitre and Vitriol, and lets drop a Powder, unles the Water be too deeply laden with Salt, for then the Gravity of this Mixture preponderates, and the Powder is buoy'd up.

In like manner Mercury dissolv'd in Spirit of Nitre, is precipitated into a white Powder, either by Salt or its Spirit, if the Water is not made too heavy with these Precipitants, as I have hinted in the Paragraph above this.

Thus Mercury dissolv'd in Aquafortis, or Spirit of Nitre, is precipitated by common Water into a white Powder, but not by distill'd or Rain Water, because neither of these contain Salt in them.

Quicksilver dissolv'd on a Fire in Oil of Vitriol, by boiling them together, is precipitated into a yellow Precipitate, call'd *Turpetum Minerale*, by fair Water, from the Sea Salt contain'd in the Water.

Butter of Antimony, which is made of the Regulus of Antimony, and sublimate Mercury sublim'd together; the Spirit of Salt of Vitriol joining in with the sulphureous Part of the Antimony, make a Butter; but upon assusing Spirit of Nitre, or upon putting the Butter into Water, an Effervescence, and a strong one too, happens with the former, and Precipitation of the reguline Parts follows, because Spirit of Nitre precipitates whatever Spirits of Salt or Vitriol dissolve; and upon dropping the Butter into Water, a Precipitation ensues, of a Powder call'd *Algaroth*, or *Mercurius Vitæ*, because common Salt, which is contain'd in all Water, precipitates any thing dissolv'd in Spirit of Vitriol, or even of Salt.

In like manner Bezoar Mineral is precipitated out of Regulus of Antimony by one Acid, whilst it is dissolv'd by another, upon Condition it be dissolv'd by one of these three, it is thrown down by another of them.

Thus Gold dissolv'd in *Aqua Regia*, is precipitated out of it by Vitriol, by Verdigrease, or by Water; by the first, because Vitriol precipitates what Spirits of Nitre and of Salt have dissolv'd; by the second, because Spirit of Vinegar precipitates what is vitriolick; and by the latter, because Salt precipitates any Body dissolv'd by nitrous or vitriolick Spirits.

The flaming Spirit of Nitre is precipitated out of Nitre alone, by Oil of Vitriol.

Silver dissolv'd in Spirit of Nitre, is thrown down by *Mercurius Vitæ*, because the remaining Part of the Spirits of Salt and Vitriol are contain'd in it, and therefore is the Silver dislodg'd out of the Spirit of Nitre by it.

The Precipitation of Ink by Air, is an Argument that the Acid of the Air is nitrous ; for Ink being Vitriol with Galls, the Acid of the Air destroys the Vitriol ; and all Ink expos'd for any time to the Air, becomes pale or yellow : What is Mildew in red Silk, but the Colour precipitated by the nitrous Spirit, that is, Alum and Salt, or Tartar is destroyed ?

Red Precipitate, which is Mercury with Spirits of Nitre, is precipitated into a white Powder by Spirit of Salt.

There is another Peculiarity yet remaining, to wit, whatever is dissolv'd in Spirit of Vitriol is precipitable by Spirit of Vinegar ; and *vice versa*, whatever is dissolv'd in Spirit of Vinegar, is thrown down by Spirit of Vitriol ; nay, Lead dissolv'd in Spirit of Vinegar, is precipitated by Salt.

Thus *Saccharum Saturni* mix'd with *Vitriolum Martis* becomes pappy ; the Cause of which we shall better comprehend, if we take a View of the Compositions of each of these Bodies ; for Sugar of Lead is made of Ceruss, and distill'd Vinegar boil'd to a Crust at Top, and set in a Cellar to crystallise ; and Salt of Steel is made of Filings of Iron, Oil of Vitriol and Water, boil'd and crystallis'd : Now the Oil of Vitriol, and the distill'd Vinegar, precipitate the Bodies out of each others *Menstruum*, and grow moist thereby ; and so it will ever happen in any Solutions with these two Spirits, that although they are dry Bodies, yet upon Mixture they will grow soft and pappy ; thus Mercury dissolv'd in Oil of Vitriol, by boiling, and crystallis'd, mix'd along with Coral or Steel dissolv'd in Spirit of Vinegar, and crystallis'd, will grow pappy.

If we enter into a Detail of the *Rationale* of these Effects, some Difficulties will occur to us, which are not so easily nor readily to be solv'd. In general, all Acids strike the Palate with the same Mode of Taste, nor do they differ in that Respect any otherwise than in their Degrees of Strength: For there is a wide Difference between the Strength of a Lemon, for Example, and of *Aqua Regia*, and we can reduce *Aqua Regia* to the exact Strength of the former by bare Dilution with Water; so that the Question started is not on account of the Taste, and by consequence we are at no Loss as to the Effects on human Bodies, where they act always with the same Uniformity; for Acids of equal Strength have, and produce always the same Effects upon us. The Question then is mainly started for the Sake of explaining mechanical Effects produc'd by them, namely, for elucidating their precipitating Faculty. On which Affair it may, in the first Place, be conjectur'd, that the essential Salt in every Body differs from that of another in Figure; and this seems to deserve Credit, because Crystals of Bodies differ in their Shapes, and the same Body does, with a stated Uniformity always afford Crystals of the same Shape; for Example, Nitre dissolv'd in Water, and fitly treated for Crystallisation, does always appear in the Shape of *Hexagonal Prisms*, Vitriol in the Shape of a Rhomboidal, and Alum in an Octohedrical Shape or Figure: This being true, or near the Truth, it is possible that the Crystals, or the Acid of one of these Bodies may be of such a Shape as to cohere with another, and let the Body, which was suspended by Dissolution, fall to the Bottom by its Gravity; the Attraction being weaken'd, the Gravity then only obtains. In the next Place, it may be affirm'd, that Bodies have a great many Adjuncts, which we have

no notice of but by Experience and Experiments; for Example, who would have known what the chalybeate Waters of *Germany* contain'd that made them taste vinous, if an *Analysis* had not detected it? In the third Place, I have already disclaim'd an exact Homogeneity of Principles, and as this is a Speculation which we could only wish to reduce to Practice; so somewhat adheres to these Salts, which causes such contrary Effects in Bodies which are of one Species, apparently to us. In the fourth Case, there is a certain Texture in some Bodies, by which they will act in a mix'd or compound Manner; that is, they evidently act as an Acid on one Body, and as an Alcali on another: Thus Oil of Tartar is a Salso-Acid, and as an alcaline Body, it will dissolve Coral as Acids do; in like manner Lime Water will precipitate Sublimate out of Water as an *Alcali* does, and yet it will coagulate Oil into a butyraceous Substance as an Acid; wherefore I think, as Acids do precipitate Alcalines, and *vice versa*, we may conclude, that some of these Bodies do contain secretly and hiddenly in their Pores alcalious Salts, by which they produce these Effects. And what would seem to add a Force to this Argument, is the following Remark which I shall make; namely, although these Salts do precipitate each other, or rather, do throw down Bodies dissolv'd in each other, yet volatile and fix'd Salts do produce this *Phænomenon* more eminently, because let Quicksilver be dissolv'd in Spirit of Nitre, it is true you may precipitate the Mercury out of this Spirit, by throwing in common Salt; however, when you have gain'd all the Quantity you can by this Precipitant, pour on the Remainder a little Salt of Tartar, you presently gain a red Precipitate, or pour on a few Drops of any volatile Spirit, and you gain a white

white Precipitate: And although it be true, that Bismuth, Lead, or Antimony, dissolv'd in an Acid of the Kinds mentioned, may be precipitated by common Fountain Water, by reason of the Salt contain'd in it, yet Silver, Quicksilver, and Gold dissolv'd in one of these *Menstrua*, don't yield to so small a Quantity of Salt as is in Water, for they require stronger Precipitates; thus these require contrary Acids, or volatile or fix'd Salts to throw them down, because they hold these Bodies more closely in their Pores, than to be so easily broken off; from which I conclude, that by Virtue of a small Quantity of an alcalious Salt conceal'd in them, they produce their Effects, but as the Quantity is so very little, fix'd and volatile Salts do it more effectually, only because there is more of such Salt in them; and if we consider, that *Colcothar* or *Vitriol* contains a fix'd Salt in it, obtainable from Lixivation, the Matter in doubt seems to be fully resolv'd; or if we consider that out of Vinegar may be obtain'd a fix'd Salt, the Affair is confirm'd.

There remains an Observation worth the Reader's Knowledge to be made; to wit, if we are obliged to administer some of these Bodies internally, Care should be taken that we avoid, as much as in us lies, giving them together; for Example, Spirits of Nitre and of Vitriol must not be mix'd and given internally at one and the same time, for the Reasons already mentioned.

Eleventhly, They flow and crackle being plac'd upon the Fire, as all Salts do.

Twelfthly, They dissolve in watry *Menstrua*, for Water is the proper Menstruum or Dissolvent of Salts, and whatever Salt does not dissolve in this Menstruum, partakes so much of Mineral or Earthy Parts, which attracting the Acid more strongly than they do the Water, it does not yield till

till the Water is heated by boiling, which Heat dissociates the Salt, and then it joins in, and leaves the Earth to subside, or till a stronger attracting Body is added to it.

Thus *Tartar* and its *Cream* made by Coction, are not properly Salts, but Salt and Earth closely join'd together; for although Water grows fourish with *Cream of Tartar*, yet the whole Mass is not dissolv'd till you use warm Water, or join a small Quantity of fix'd Salt to it, and then all the Salt is blended with the Water, and the earthy Parts subside.

In like manner *Arcanum Duplicatum*, which is Salt that remains at the Bottom of the Retort after the Distillation of *Aqua fortis* obtain'd by washing; *Tartarus Vitriolatus*, which is a Salt got by joining Oils of Tartar and of Vitriol together, and exhaling after their Effervescence is past to a Dryness, are not intirely Salts, but Salts blended with a great deal of Earth, and therefore they are with Difficulty dissolved in Water; whereas *Nitre*, common Salt, Salt Armoniac, Vitriol, alcalious Salt, Sal Gem, and others, are readily dissolved: In the Solution of the former in cold Water, there remains at Bottom a slimy and grey Substance, which requires warm Water to dissociate and dissolve it; and then if you please to place this Solution filtered in a cold Place, you gain Crystals agreeing exactly with *Tartar vitriolated*, or a bitter Salt.

Thirteenthly, All Salts are discovered by their different Sorts of Pungency, and this Pungency is discoverable by the Nostrils, or by putting the Bodies into the Corners of the Eye more nicely than by the Tongue, which is daily accustom'd to them, and therefore feels them not so well.

The next Inquiry must be made concerning the Difference of Acids; for as they are not Homogeneal, there certainly are many *Adjuncts* in

in them, which cause a wide Difference in their Operation, and which it becomes us to take notice of.

The most usual Differences observ'd are the following, namely, some *Acids are Astringent*, because they are join'd to a great deal of Earth, which causes them to be vitriolick Salts, and then they corroborate our Fibres; or they are *Tartareous Acids*, and then they irritate and gently corroborate, such are Cream or Crystals of Tartar, and the like; and others are *concentred Acids*, such are Spirits of Salt, of Vitriol, and the like, and they irritate and coagulate, having a strong Effect upon the Solids and the Fluids also.

These latter, or concentrated Acids have the Power of effervesing with alcalious Bodies, and with concentrated or volatile Oils, whose Composition will be illustrated in their proper Place.

It is very difficult to say whether we can intirely divest Acids of their Earth; for whenever there is an Acid of any Kind, it is found to corroborate or constringe, even where it proves a Caustick, that is, it has eminently a corroding Property, and in Process of Time it also constringes the Vessels: This appears evidently in Spirit of Salt, when it is made use of in *Dyspepsiotick Ulcers*; when, for Example, Surgeons cannot close the Lips of some Ulcers, they dip a Feather into Spirit of Salt, and draw it over the Ulcer, the Spirit eats off the Fungous, or other putrid Flesh, after which the Secretion stops, and the Ulcer heals. In this one Instance, the corroding and constringing Power appear very evidently, and I have received the Thanks of some to whom I communicated the Secret; but it must be so often repeated, till the Fungous Flesh is quite carried off, before a Cure can be expected; and indeed, Acids are most commonly join'd to Earths.

A

As a further Proof that it is no easy matter to rob Acids of their heterogeneous Parts, we find that the *Spiritus Vitrioli Philosophicus*, which is the Water that is impregnated with the acid Salts of the Butter of Antimony in making *Mercurius Vitæ*, in length of Time grows sweetish, and so does Treacle Water; and out of Spirit of Vinegar we gain Spirit of Wine, as out of the acid Spirits of Woods by Chalk we obtain an Oil; and this is the Reason why Spirits of Wine grow mellow if they are long kept, for the Acid in the Spirit attracting and working with the oilius Part, do at last make up a Sweet. Whether therefore the Oil abounds and predominates in the latter over the Acid, or whether the Acid exceeds the Oils in the acid Spirits, yet both sweeten and mellow, for the Reason here mentioned, and convince us of the Difficulty of separating heterogeneous Parts; and although what I am about to mention, does not strictly appertain to the present Head, yet it shews us how difficult a Matter it is to separate Parts from Parts; dissolve, for Example, Sea Salt in Water ever so often, it will still deposite Earth to the Bottom continually.

It is an Observation, that the sooner Fire penetrates any Body, the longer it is in being heated; but as strong Acids are twice as soon expanded as weaker Acids or Water, it appears they are not near so porous as either; for they are specifically heavier, and do therefore retain the Fire, nor do they suffer it to penetrate, and consequently are sooner heated: From this Remark it may be inferr'd, that Acids are less porous than alcalious Bodies, and in Fact, they are specifically heavier; wherefore the Pores of Alcalines must be larger and fitter to receive the Acids, than to be received by them: Hence have some Chymists call'd Acids, *Males*, and Alcalines, *Females*; and not

not improperly, although they did not, I fear, at the Time of such Denomination, proceed upon the Foundation here mention'd.

We now come to consider these Properties in Acids, by which they become of Use or dangerous to Mankind ; where I shall range them under the following Heads, to wit, I shall prove them to be *solid and hard*, to be *Conical*, penetrating of themselves, *Elastick*, *Attractive*, *Heavy* : I shall consider their *Size*, and their *Divisibility*.

Their *Solidity and Hardness* is proved by the following Experiments.

1. There is no Acid yet found, which has not Earth join'd to it, as appears by any Species of Salt containing Acid, and more especially in Sea Salt, which always deposites Earth when dissolv'd in Water ; for after you have dissolv'd this Salt in Water, and have suffer'd it to stand a while, so as to suffer the Earth to drop to the Bottom ; decant the Water off ; exhale the Water to a Dryness, then dissolve it in more Water, it will again deposite more Earth ; and although you was to repeat this Operation a thousand times, the same will ever happen ; nay, if you decant the Water, and let it stand, it will answer in the same Manner.
2. If you take Oil of Vitriol, and gently evaporate it, and set it in a Cellar, it will turn into Crystals ; and Lemery says, that he twice distill'd Vitriol into an Oil, and it all became a dry Salt in the Vessel, that was so Caustick, that he could not bear it, but was immediately obliged to put his Hand into cold Water ; and it is a common Observation, that the Glass-stopper is lin'd round about with a white dry Salt ; also if you exhale

exhale Oil of Vitriol to the whole Consumption of its Moisture by a gentle Heat, as may be perceived, because when all its Humidity is exhaled, it smokes no more, then place it in a cold Cellar it becomes an icy Salt, but melts with the least Heat: Again, if you take rectified Spirit of Amber, and evaporate the Water from it till about one third is consum'd, and place this also in a Cellar for the Space of ten Days, and you obtain Crystals of Amber, or its acid Salt in a dry Form; this is a pure essential Salt of Amber, free from any Mixture of volatile Salt, as some say, although others say it contains a volatile Salt mix'd with it. And, as Crystals, are a Composition generally of acid Salts, Earth, and a fix'd or volatile Salt, as appears in the following Experiment, to wit, take Salt of Tartar and mix it with rectified Spirit of Wine, evaporate all the Spirit, and you have Crystals at the Bottom; or distil the Spirit off ever so often, there still remains at Bottom a *Tartarus Vitriolatus*; in the same manner other Crystals may be a Mixture of various Salts. So Vitriol and Alum are hard, and contain Earth, because they don't run as Nitre or Salt do in Distillation, and their Spirits by Evaporation become dry. The last Proof of the Hardness of acid Salts, and of the few Pores they have relatively with other factitious Salts, is the small Space of Time they require to be heated over a Fire; for, as I observed above, those Bodies are the soonest heated over a Fire, which resist the Passage of the Fire most: Now by this Rule, weaker Acids are later in growing hot than stronger, because they suffer the fiery Particles to pass out of

them readily, whereas the stronger retain them all, and grow sooner hot thereby.

This Hardness, Solidity, and Texture is sometimes so invincible, that if the Bodies are at the same time sharp or acuminated, they become corrosive and caustick, as appears in the most concent'red Acids.

From hence it is justly inferr'd,

1. That acid Bodies are capable of resisting, and conquering resisting Bodies.
2. That according to their Quantity of Matter or their specifick Gravity, they press other Bodies, and force their Passage thro' them.
3. That according to their Hardness and Solidity, they become more or less absorbing ; the lighter Acids having more Pores in them, are more capable of performing this Office, whereas the heavier and more solid are less drying and exiccant.

They are evidently more solid than volatile Salts, because to make them mount up into the Receiver, they require a much greater Impulse than these, nor do they by any such Force even at last mount high at all, and they readily fall down again whenever they are out of the Sphere of that impress'd Force ; as has been mention'd under Distillation, to which Place I refer my Hearers ; and as it will appear by weighing a Cylinder full of each.

4. That as Bodies are attractive according to their Quantity of Matter, and as Acids have a great deal of Matter under a small Bulk, therefore they attract various Bodies, and become active thereby.

1. For Example, they attract watry Bodies so long as there are Particles of Water to be attracted, and they run with a greater Force towards the Water than they attract themselves, therefore are they diffused through the whole watry Body, and as they are divisible *in infinitum*, the more Water there is, the more are they dispersed in its Vacuities, till at last they give us no Notice of their Presence, save by Experiments; for one Grain of a concenter'd Acid will acuate seven hundred and twenty Grains of Water, so as to be perceptible to the Taste, but when we add more Water, the Acidity becomes imperceptible to our Palate. If there be four hundred and eighty Parts of Water to eighteen of any Acid, that is, if there be more than twenty-six Parts of Water to one of Acid, the acid Taste will be well perceived, and be an agreeable Acid; and this is the Case of Vinegar.
2. They are attracted by volatile Oils, and by their rushing against them with Force, they suffer a Collision, thereby they excite a Heat, and raise Bubbles, and cause Fermentation, and even Fire; from such an Attraction arises Putrefaction, with all its Effects: In all Commotions of this kind there are Collisions and Resilitions, there are repeated Attacks and Recoilings, as they who will give themselves the Trouble to view this Struggle thro' a Microscope may convince themselves.

There are two Things to be inquired into in this Commotion, as Conditions without which the Effects don't follow; namely, what sort of Oils are required, and what kind of Acids must be made use of: as for the Oils, they

must either be highly concenter'd, or they must be volatile Oils ; and as to the Acids, none but the most pure and homogeneal will answer.

As for common Oils, they only coagulate together, and turn into a sort of Balsam, as I have noted among Oils ; but with the essential or volatile they also grow hot, and even flame out with the strongest Acid ; I can affirm nothing of the concenter'd Oils, but as a Rancor, which is the Embryo of a volatile Oil, is produced in common Oils, there is Reason to conjecture, that they also will be heated by a Mixture with Acids.

As for the *Acids* that perform this Feat, they have so much more Motion in them as there was more Fire required in acquiring them, for the Fire puts them in Motion, and makes them active, even the most active Principle in Nature ; and considering that they have at the same time a great Solidity, and that all Attraction is always either in Proportion to the Quantity of Matter in, or Distance of Bodies, they are the most active and attractive Bodies in Nature ; and from hence it is, that they attract Oils, move them, and raise Heat and Fermentation : The Force therefore of these Acids is not only in a *Ratio* of their Gravity, as some have affirmed, and that the heavier they are, and the more acuminated they are, the stronger they are ; but this Fire which they contain in their Pores must be pass'd into the Account, and it must be affirm'd, that their Force is in a compound Ratio of the *Fire* they contain, their sharp *Points*, and their *Gravity*.

However, Colluctations do ensue from Oils and Acids conjoin'd, altho' Fire does not always issue; and such Struggles as are fit for Fermentation, when there is a great deal of Water that causes these Motions to be moderate.

As to the Order in which these Oils are attracted, we have plain Instances to prove that Acids do first attract Salts and Earths before they attract Oils; and that they first attract fix'd before volatile Salts: I shall produce some Examples to strengthen this Assertion; we find a Horror or Shivering precedes the warm Fit in Fevers, which seems to depend on the volatile or fix'd Salts being first attack'd by the Acids, and then the hot Fit succeeds from these same Acids attracting the Oils; for Cold arises from a Mixture of Salts always and only; whereas Heat arises from Oils and Salts, as well as from Salts and Salts: And to confirm this Reasoning, we find that Fruits are first acerb and sour before they grow mellow and sweet, which shews that the Acids and Earths do first attract each other, but in process of Time the Acids and Oils do approach, and then the Fruit ripens or sweetens; and this Work of Nature is imitated by Art, where sour Fruit grows soft by Friction, and tastes sweet after a while; and Acids do attract fix'd Salts more effectually than volatile ones, as appears in the Instance of Quick-lime and Salt of Tartar, which absorb and join in with the Acid of crude Sal Armoniack, and the volatile Salt flies up immediately; from whence it may fairly be inferr'd, that *fix'd Salts are more alkalious than Volatiles.*

I shall now proceed to give you Examples of the known Effects that Acids have upon Oils. First, *they effervesce, and even fall into Flames sometimes with them; ex. gr.*

1. If you mix one Part of Antimony with two or three Parts of Salt-petre in Powder, and commit them to the Fire, they detonate and make a *Diaphoretick Antimony*; the more they detonate, the more diaphoretick they become, and the less emetick they are; the Reason of this Detonation is, that Antimony contains sulphureous Parts, and Nitre an acid Spirit, which two assisted by the Fire, turn into Flames and shining Fumes: And it must be observ'd, that upon the same Account Nitre does not only turn into Flames with Antimony, but even with any sulphureous Body; wherefore Tartar itself will flame with Sulphur, because there is an oily Substance in Tartar; and the same happens with Nitre and Charcoal, because it contains Oil.
2. If you mix Powder of Iron with Brimstone in equal Parts, and with a little Water make them into a Paste, in a little time they grow hot and will burst into Flames; but you must powder the Iron into an impalpable Powder to make this Experiment answer; and from this one Experiment alone we draw the Reason of *Volcano's*, and of the Heat of Bath Waters.
3. If you pour strong and smoaking Spirit of Nitre upon Filings of Iron, there arises an Effervescence and a great Smoak, as if Flames would ensue.
4. If you pour *Aqua Regia* upon Gold, there arises presently a strong Heat and Fume, particularly if you assist with a small Fire.
5. Nay, if you mix Leaf-Gold along with Quicksilver, and stir them together, they will grow so hot as not to be born in the Hand.

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We know that Gold by a strong and tedious Trituration will swell, and other Marks shew it contains a fine Oil in it ; and Mercury placed in an Iron Vessel will rust it, which therefore contains an Acid ; but these two, namely, a fine Oil and an Acid effervesce ; it is no Wonder then that Leaf-Gold and Mercury mix'd together should effervesce.

6. If you mix smoaking Spirit of Nitre and rectified Spirit of Wine together, and make use of a little Heat, they will fulminate.
7. Butter of Antimony mix'd along with Spirit of Nitre, there arises an Effervescence, a Noise, and a Smoak, and, *Sennertus* says, a Flame.
8. If to Oil of Vitriol and Filings of Iron we add a little Water, there arises a grand Commotion.
9. If to Aquafortis or compound Spirit of Nitre you put Oil of Turpentine, even the heavy Oil, Oil of Cloves, or any other chymical or essential Oil, there does in an Instant follow a high Commotion, and a Flame rises up, and this Effect will ensue, even if you put the Oil into a Bason of Water.
10. Regulus or Powder of Antimony mix'd with sublimate Mercury do immediately grow hot ; you must observe to powder them apart in a marble or glass Mortar ; these sublimed make *Butter of Antimony*.
11. Chalk and *Aquafortis* put together do raise an Effervescence, and we gain from this Mixture a *Phosphorus* ; and let us distil any * *Phosphorus* whatever, we obtain from it an acid Spirit and an unctuous Matter.

* *Memoires d'Academie de Science, Anno 1706.*

12. If we take seven Parts of Alum and one Part of wheaten Flower, if we calcine them thus mix'd, till they become black and cease to smoak, then put the Powder into a heated Glafs, and keep it; lay a little of this Powder upon a Piece of Paper, and double it, rub it with your Fingers, it will set the Paper on Fire, and is a *Phosphorus*.
13. If you put Spirit of Nitre upon Silver, they will raise an Ebullition, and cause a great Heat; to this Dissolution add crude Tartar, evaporate to a Dryness, and you have an *Argentum Fulminans*, which being placed upon a Fire, will fly off: And the *Aurum Fulminans* is Gold dissolved in *Aqua Regia*, and precipitated by Spirit of Sal Armoniack or Oil of Tartar *per Deliquium*, and dry'd; it fulminates upon a Fire and flies off.
14. Chalk and Aquafortis mix'd together into a Paste, which refuds whatever Light it receives, that is, of itself becomes a *Phosphorus*.*
15. Oil of Vitriol and most rectified Spirit of Wine blended together do raise an Effervescence, and a Substance of a pitchy Nature subsides.
16. Gunpowder, which is so readily turn'd into Fire, is made of Sulphur, Charcoal, and Salt-petre; and it is made much stronger by adding *Aqua Regia* to it to a certain Proportion; for Example, to seven Parts of Salt-petre put one Part of Sulphur, half a Part of Charcoal, one quarter of a Part of Salt of Tartar, dissolve all these in *Aqua Regia*, and dry, and you have Coborn's strong Gun-

* Vanderbeeche, p. 391.

powder,

powder, that is extremely strong, and will carry Bullets to a much greater Length than common Powder does: And as *Talc* detonates with Salt-petre, it contains some Oil in it, and this is the Reason why some have sought for an *Oil of Talc*.

17. If along with Gunpowder you mingle Oil of Turpentine, you make an *Ignis Phrygius*, or a wild Fire, that will burn under Water.

18. All Coals have in them an oily Substance join'd to an Acid; and if Tallow had no Acid in it, we should not have Candles burn so well; hence some Tallow is not so fit as others for that Use, for want of more Acid in it, and if we add a little of a concen-^{ter'd} Acid to some Tallow, it will burn the better; which is a Secret our Chandlers have not yet hit upon.

19. If we mix Lapis Calaminaris along with strong Spirit of Nitre, and exhale the Moi-
sture, then if to this we put rectified Spirit of Wine, they will rise into a Flame.

20. If we take Copper, Bismuth, Tin, or Iron, and pour on Spirit of Nitre, there arises a strong Effervesce and Commotion.

21. We observe that small Beer won't keep well in Summer, because the oily and acid Parts are in Motion, and an Evaporation of the more spirituous or active Parts fly off; and it is observed, that if Bran be put into Water, in ten Days there arises a Heat between the oily-acid Parts. *Stum* is the Froth of fermenting Wine kept close in a cool Cellar, it is sweet, and consists of oily-acid Parts; it serves to ferment dead Wines anew; and may also serve to ferment our Beer in lieu of *Barm*, which is the Stum of Beer, and consists of the same fermenting Parts.

22. Sugar

22. Sugar is an oily-acid Body, as appears by Distillation, and it is intirely an inflammable Substance ; nay, and Gunpowder may be made from it.
23. Fire is observed to be raised from oily-acid Bodies, and all Combustibles are fraught with such Particles ; and we observe, that Oil is not so apt to burn or flame as Sulphur, which contains an Oil and Acid.
24. If to one Part of Tin you put three Parts of Quicksilver, and amalgamate them together till they become like Butter, then take one Part of this Amalgam and two Parts of sublimate Mercury, mix them and distil, and you get a Liquor that smoaks whenever it is exposed to the Air : the Spirit is therefore *Sulphureo-acid*.

From these few Observations drawn from Experiments on Bodies, we learn, that Fire has for its Principles Oils and Acids, and that this is the chymical Consideration of it, and if we view it mechanically, it is a minute, solid, polish'd Body, swiftly and vehemently moved, consisting of penetrating Wedges, and that its Origin and Support is from Oil and Acid : I refer you to the Introduction for a further View of it.

As to the Quantity or Proportions required of these Bodies to produce these Struggles and Comotions, Practice alone is the best Guide to determine them ; however, *Tackenius*, and *Keill* after him, do allot a small Quantity of Acid to a large one of Oil, and it suffices ; the former even says, that one eight hundredth Part of Acid is sufficient for a Ferment, and that more extinguishes the Power ; and if the Acid be an artificial one, that is, be made by the Fire, its motive Force will be the greater, and it will sooner exert its Power ; and

and therefore in the Works of Nature, the Heat of the Sun does gradually cause it to operate, and without this adventitious Circumstance we should find no Fructification or Vegetation at all : for Fire is the *universal Mover*, and if we want the Sun's Warmth, we must imitate it by Art, namely, by Hot-beds, or somewhat equivalent to them, such as hollow Walls to receive Smoak and heat them thereby, so that Vegetation may be hastened and promoted.

There are so many *Phænomena* depending upon this Property of Acid, that it would fill a Volume to descend to them all ; I shall only instance in one well known to us ; if, for Example, we consider that the Sun-beams fill the Air with their fiery Particles and float in it, as all Fire is an oily-acid Body, this compound Matter may undergo various Chances ; if then they are blended with Moisture and shut close up, they ferment together and produce a Putrefaction, and this in Chambers produces a Mustiness ; and if a Calm happens in hot and moist Weather, malignant, epidemical Fevers, and even Plagues themselves may rage ; for the oily-acid or fiery Particles of the Sun are diluted and put into Action, even so much that in hot Countries, under the Equinoctial, the Rains will corrode the Cloaths, and exulcerate the Skins of the Travellers : but of this Appearance more in the Sequel of these Lectures.

In many of the foregoing Experiments there may be some Doubt concerning the Principles of the acting Bodies, and this will chiefly rest upon the Metals, and more especially where Metals act upon each other ; that is, it may be wonder'd that Quicksilver and Gold should grow hot, when blended together ; but if we reflect, that (as has been said) Gold by *Trituration* in a Mortar for some time smells, and that if Quicksilver be put into

into an Iron Pot and stand there for some time, the Iron grows rusty: These are Instances proving that there is some volatile and fine Oil in Gold, and that there is an Acid in Quicksilver, and as these are not fictitious Instances, and discover'd without the help of the Fire, none will be so fool-hardy as to deny the Fact nor the Proof; at least, till the Proof is weaken'd by a better, it must stand the Test: If this one Instance be true, we may rest well satisfy'd, that lighter Metals, and more especially Metals join'd in with Sulphur, will effervesce much more suddenly and vehemently.

And if the Laws of Motion obtain on the Earth, as they do in the greater Bodies, then it will be true, that *Bodies which attract each other, do attract with Celerities, that are inversely as their Masses*; then as Acids are specifically heavier than Oils, Acids are the most attractive Bodies of the two, in the same Bulk, and the Oils will move towards them with Swiftness; but this Attraction depends on Distance, as the *Attraction of Cohesion* does.

Secondly, *Concenter'd Acids in a large Quantity do corrode Gums, Resins, viscous Bodies, Flesh, Bones, Stones, and Metals, as also Linnen and Cloaths.*

1. If to Camphire you put *Aquafortis* or strong *Spirit of Nitre*, the Camphire becomes an Oil; and thus is made the *catheretick Oil of Camphire*, by mixing one Part of Camphire with two Parts of Spirit of Nitre, and digesting for two or three Hours, these two Bodies unite into one: The Oiliness of the Camphire hinders the Mass to be too acrimonious, however it is sharp enough for putrid Flesh and carious Bones: There is one

one thing that occurs in this Mixture, which seems to contradict the Sentiments we have settled, namely, as Spirit of Nitre is a pure Acid, and Camphire is a volatile oily Salt, how comes it about that the Dissolution is made without either Heat or Ebullition? To which this Answer may be given, that where a Body is laden with gross oily Parts too much, they put a Stop to any Effer-vescence, as I have hinted in the Lecture on Oils, where Oil added to Coral and Spirit of Vinegar stops their Huffing presently: However, the Spirit is so strong as to destroy and dissolve the Body; and if we would return the Camphire, we only pour on Water, which weakens the Spirit, and then it lets the Camphire go, which immediately emerges. And that this is the Case with Camphire, appears very evidently; for if you take Camphire powder'd and mix it with *Bole Armo-niack* or *Terra Sigillata*, or indeed any other earthy Body, and distil it, you obtain only a butyraceous Oil, but if you again put this thick Oil into tartarised Spirit of Wine and distil, you gain then a thin Oil that swims upon the Spirit of Wine; hence this Camphire may justly be reputed a *resinous volatile Salt*, or a *resinous, volatile Oil*.

2. *Glass of Lead*, (which is made by calcining Minium, Litharge, or Ceruſs, along with three Parts of pure Sand, and then adding Nitre, and calcining, you get the said Glass) is dissolved in *Aquafortis*; it is an Oil, because it swims upon the Metal; it is true, that it is also an Earth, because we revive it again by a Flux Powder.
3. Spirit of Nitre corrodes the sulphureous Part of Antimony, and so does *Aqua Regia*; after

after such a Corrosion the sulphureous, as well as the reguline Parts of the Antimony are united to the acid Spirits, and they become one Body, as caustick as may be; and Antimony prepared in this Manner is emetic in the minutest Dose imaginable; and as *Butter of Antimony* is partly sulphureous, partly reguline, Spirit of Nitre dissolving the Butter, the Mass becomes highly caustick, and unsafe for inward Use; and were the Antimony very sulphureous, we should not have so great an Ebullition as happens on this Occasion.

4. *Osteocolla* is a Substance between a Stone and an Earth, for it is a petrified Marle, is eroded by Spirit of Vinegar, and it becomes thereby an Acerb, fit for external or internal Use, because the Spirit of Vinegar being a weak *Menstruum*, and this earthy Stone having no noxious Parts in it, the Compound may be ventur'd upon as a Styptick.
5. Sand is soluble in *Spirit of Nitre* or in *Aqua-fortis*, and therefore Glaſs reduced to its Principles, as will be shewn hereafter, is readily dissolved again in the same; but as the *Menstruum* is noxious and corrosive, therefore such a Mixture will be more so, by the Weight added to the Spirit.
6. Sponge is soluble in Spirit of Salt, but this is not much to be wonder'd at, because it is a Substance very soft, and moreover, as Sponge is found in the Sea, it contains a good deal of Sea Salt in its Pores, and therefore the Spirit of Nitre becomes a Dissolvent upon a double Account, as may appear from the Contrariety there has been observed above between Spirit of Nitre and Sea Salt.

7. Bismuth is dissolved in *Aqua fortis* or *Spirit of Nitre*, which is both a reguline and sulphureous Body; the metallick Part is Tin, and the other an arsenical Sulphur, but both these are corroded by concenter'd Acids, and here also no Ebullition would follow, unless the reguline exceeded the sulphureous Parts.
8. Talc is dissolved in *Aqua fortis* and in *Aqua Regia*, as these Salts are highly acid, and in the latter it is all dissolved, because it often contains Gold.
9. Mercury is dissolved in Oil of Vitriol, if they are boil'd together.
10. Bones boil'd in Vinegar become a Jelly: and as in *Papin's Digestor* we find that Bones do turn into Jelly, we have Reason to think that it is done by the same Mechanism, for the Fire is an Effect produced by an Acid and Oil put in Motion: and also as Coral, Pearl, Egg-shells, and even Tin, Lead, Antimony, and Soot are dissolved by vegetable Acids, such as Vinegar or Juice of Lemons, we may conjecture, that this Solution of Bones by the Fire is done in a like Manner: If you calcine Vitriol in a glaz'd earthen Pipkin, the Vitriol corrodes the Lead, and causes it to vanish, for the Spirit of the Vitriol exerts its Force and dissolves it.
11. Benjamin is quite eroded, and in like manner are other Gums, with the smoaking Spirit of Nitre; because if to Tincture of Benjamin you pour on a little Spirit of Nitre, at first the Tincture grows thick and white, and the Gum is precipitated, but by pouring in a little more of the Spirit, the Gum is quite eroded, and the Mixture becomes once again a transparent Tincture.

12. Jellies and glutinous Bodies are dissolved by concenter'd Acids in an Instant; thus Jellies of Hartshorn, Calves-feet, or of Gums Tragacanth and Arabick, or any other, are soon dissolved by a little Spirit of Nitre or Oil of Vitriol; nay, as Coral dissolved in Vinegar and digested with Spirit of Wine becomes a Jelly, or as Sugar of Lead digested in Spirit of Wine does also become a Jelly, and as these are dissolved by Spirit of Nitre into a thin Substance, we have great Reason to conclude, that all gelatinous Bodies may be dissolved or corroded by these concenter'd Acids: I have taken the vitreous Humour of the Eye and have soon dissolved it by *Aquafortis* or Oil of Vitriol; I have also taken the *Mucus* of the Bladder, which had been shaved off by a large Stone, and which is always a concomitant Sign of a Stone in the Bladder, and have dissolved it presently with Oil of Vitriol; and as I have suspected a *Gonorrhœa* to be virulent, from the yellowish and greenish Colour the Matter was died with, and I could not otherwise be convinced that it was not such, I have procured some of it to be kept, and have found it not to be virulent, because the whole Matter dissolved in Oil of Vitriol; for had it been *purulent*, no Acid, however concenter'd, would have dissolved it; and by this one Criterion alone any Physician may venture his Reputation upon pronouncing whether Matter be a colour'd Mucus or *Pus*, *Virus*, *Sanies*, or *Ichor*; because the latter four being *purulent*, will not dissolve, but remain untouched, whereas *Mucus* will all be dissolved or corroded, and make one Body with

with the Acid pour'd on: In the same Manner have I distinguish'd a *putrid Mucus* spit up from the Lungs from a *purulent Matter*, because the first Matter is dissolved, but the latter does not: There is a History in *Riverius's Observations* of this kind, and we often meet with Hecticks and Coughs where a variegated or discolour'd Spit is thrown up, but yet there is no Ulcer in the Lungs, and were it not for such an instructive Method, we might be misled to pronounce Death to the Patients, and so leave them to Chance, when they might be cured; indeed it never happens in the last Stage of a Consumption, where the Lungs are really ulcerated, but *Mucus* is spit up mix'd with *Pus*; however, by pouring Oil of Vitriol, Spirit of Nitre, or any other acid Spirit upon the Matter, the *Mucus* disappears, but the purulent Matter remains undisolved, and then you may readily and safely pronounce, that the Lungs are ulcerated. This first evidently appear'd to me in an Imposthume of the Liver, of which a Patient died after it had broke externally, we met with a great deal of this mix'd Matter in the Liver, the mucous Part of which did readily dissolve in these concenter'd Spirits, but the true *Pus* remain'd untouch'd: As a further Proof of this corroding Property in Acids, it is observed, that if we take the Spirit of Guaiacum, which is an *Acid*, and mix it with Chalk, and rectify it, the Oil, which lay hid and dissolved, and imperceptibly conceal'd in the Spirit, will then mount up in its own proper Shape, distinct from the Spirit, which makes a fair Confirmation of the Matter asserted; thus the

* *gilding Powder of Antimony*, which is a Sulphur, is so destroy'd by Oil of Vitriol, that if it is design'd as a Cheat, you readily discover it. In like Manner *Cucumbers* that are long pickled become soft and useles, for the Vinegar in Proces of Time becomes stronger, by Evaporation of the watry Parts into the Air, and corrodes what at first it had render'd crisp and hard; for you must know, that *Cucumber Juice exposed to the Air* is a *Jelly*, or turns into a mucous and watry *Gum*. We have proved in the *Lecture of Oils*, that a red Colour depends on an Oil congeal'd by an Acid, wherefore black *Cherries*, which we use for making *Black-Cherry-Water*, die the Hands of the Servants, that press them, of a black red Colour; to take off which Stain, they make use of Oil of Vitriol in Water, for washing their Hands; the Reason of which Proceeding is to destroy the colouring Parts, that is, the *concenter'd Acid* erodes the sulphureous and oily Parts, before only coagulated by a gentle Acid, and quite causes the Colour to disappear. So much may we be convinced of this Property in Acids, that if you expose Jellies to the open Air, they grow thin and putrefy, and can never again be made to congeal; this Experiment we have to produce to confirm this Truth, that if you expose the Jelly of *Isinglass* to the Air till it becomes thin, you cannot again recongeal it: Thus *Bread is corroded by Oil of Vitriol*, for

* Take Antimony one Part, Nitre two Parts, Tartar one Part, fuse them together in a Crucible, then pour cold Water upon them, make a Lie of them, filter, evaporate, and there remains a Powder at the Bottom, which is call'd *Gilding Powder*, and it gilds Silver; it is a *Sulphur Antimonii Deauratum*.

Bread

Bread is a Mucilage, but may be made as hard as a Stone if we steep the Bread in the Liquor Silicum, and pour on any strong acid Spirit. Some * have told us, that no other Gum is dissolved in Spirit of Nitre, save Camphire; but if you look back into what has been said of *Spirit of Nitre* and the *Tincture of Gum Benzoin*, you will readily conclude, that this Gum, and indeed all others, will undergo the same Fate of Dissolution, if they are render'd fit for it, that is, if they are first made into Tinctures, so that the Spirit can find Entrance; and this is a Condition required in other Cases; for altho' Metals can be dissolved by *Aquafortis* or *Aqua Regia*, yet both Pulverisation and Heat are Conditions without which these Menstrua will not produce their Effects: In like Manner must Gums be prepared for Dissolution by making them into Tinctures, or by heating them; Camphire indeed is very spongy, and therefore yields more readily, but even this must be assisted by Heat, which promotes the Dissolution, and causes the Spirit to enter into its Body: Do we not experience the same Difficulty in the Dissolution of Mercury in Oil of Vitriol? for till the Heat, and even a Heat that boils the Oil, concurs, and expands the Mercury into a greater Bulk, the Oil cannot enter, nor dissolve and corrode the Quicksilver. Wherefore, if we observe the Conditions necessary for rarefying Bodies to a certain Pitch, this Spirit will dissolve Gums of any kind, nor will this Property assigned to Acids be at all defeated, neither can there occur any Exception to it.

* Lemery, p. 480.

13. Steel or Iron are dissolved by even the weakest Acids, as well as strong ones, insomuch as the vegetable Juices of Barberries, Apples, of Quinces, or of any other sour Vegetable are its *Menstrua* for making a Tincture of Steel, and Juice of Lemon turns a Knife-blade black, and so does Bezoar powder'd in an Iron Mortar; Tartar and Water dissolve Steel by boiling together, and make a *Tinctura Martis Tartareo-salina*, which was Dr. Willis's *Arcanum*, and they dissolve in Oil of Vitriol, Spirit of Sulphur, Aqua Regia, or Aquafortis.
14. Glass itself is dissolved specifically by Spirit of Salt; however, it is certain, that no acid Spirits can be long kept in Glass made of light and corruptible Matter, so that if the Ashes are light, the Glass is soon corroded, and we see in Fact, that the Air corrodes the Glass of our Windows; and I don't at all question that Morboffe's Liquor, by which he could convert Glass into a flexible and malleable Substance, must have been some of these Acids; we also find that in distilling Spirit of Salt Armoniack with Lime, the Glass is corroded by its Acidity into a Roughness.
15. Gold is dissolved in Aqua Regia only; and Spirit of Nitre being saturated with Salt-petre or with Salt Gem dissolving Gold, is therefore an *Aqua Regia*, and Aquafortis being distill'd from an equal Part of Nitre becomes an *Aqua Regia* that dissolves Gold; and as Spirit of Salt by adding Salt-petre or Spirit of Nitre dissolve Gold, this Mixture also is an *Aqua Regia*.
16. Silver is dissolved by Spirit of Nitre or Aquafortis; and if to this you add Water and filter, this Liquor will die the Hair black;

black; but Silver is not dissolved by Spirit of Salt.

17. *Quicksilver* is dissolved by Aquafortis or Spirit of Nitre, or with Oil of Vitriol when they boil together; it is true, that Aqua Regia will dissolve Quicksilver, but not so soon as Aquafortis.

18. *Copper* is dissolved in any Acid, whether strong or weak; hence Vinegar or Spirit of Vinegar will dissolve it as well as Aqua Regia or Aquafortis or Spirit of Salt.

19. *Tin* is dissolved in Aquafortis, Spirit of Nitre or Aqua Regia; for in Aquafortis it is dissolved into a Calx.

20. *Lead* is dissolved in any weak or weaken'd Acid; hence it is dissolved in Vinegar, Spirit of Vinegar, or in Spirit of Nitre, or other concenter'd Acids well diluted with Water; but Spirit of Salt is too strong for Lead alone.

From these Examples is made to appear the Structure of Metals; for Gold is the firmest, and Lead the most loose, since any weak Acid dissolves the latter, and nothing but Aqua Regia the former.

21. Antimony is dissolved in Spirit of Salt.

22. Cloth, whether Linnen or Woollen, Paper and Silks are all corroded by Acids; nay, the Acid in the Air mildews Silks, and will corrode Paper so that it will moulder away, as daily Experience shews us.

Thirdly, *Acids in a small Quantity extinguish Motion, and coagulate Oils, or if they are not concenter'd they produce the same Effects.*

1. We make an Ointment call'd *Nutritum* with Oil Olive and Oil of Tartar, Lime-water, or Sugar of Lead, blended together; this Ointment is call'd Butter of Lead when made with Sugar of Lead.
2. *Aquafortis* or *Spirit of Nitre* with Oil and a moderate Heat make Oil Olive into a Substance much resembling Fat, when all is cool'd; and Oil of Vitriol makes Oil Olive into a pitchy Substance.
3. Aloes and Myrrh mix'd with strong acid Spirits harden into a Substance like Coal; therefore *Elixir Proprietatis* is improperly made with the acid *Spirit of Sulphur per Campanam*.
4. As Spirit of Wine is an oily Substance, and as Salt of Tartar does not take off the Acidity of Spirit of Salt Armoniack quite, the Acid of the Spirits coagulates the oily Parts into what is call'd *Offa Helmontiana*, which is a Jelly.
5. Sulphur fixes volatile Oils, therefore there is an Acid in Sulphur, which we are confirm'd of by Distillation.
6. Gunpowder moisten'd with Oil or Spirit of Vitriol, and then dry'd, will not take Fire, and becomes uselefs; hence for Providor's to buy Gunpowder of Enemies is dangerous.
7. The *Liquor of Flints* coagulated with equal Parts of any acid Spirit, becomes a glutinous or stony Substance, and therefore Bread made up with this Liquor, or however moisten'd with it, and also moisten'd with an acid Spirit, will become as hard as Stone: Now this Liquor of Flints is made by a Calcination of Flints, the calcined Matter is powder'd and mix'd with Salt of Tartar and put in a Cellar

to run into Liquor ; it is evident, that there must be some stony Parts in the Liquor as well as some oily ones, because without the first there would be no Hardness, and without the latter no Coagulation ; and as the same Feat is done with the *Caput Mortuum* of Spirit of Salt Armoniack, made with Lime and Oil of Vitriol, we are confirm'd in our Conjectures ; for Lime-stone, as all know, sweats out fetid Oil in burning, and the rest is Stone ; so that the stony Parts are enveloped with Oil, and the Acid coagulating the Oil, the stony Parts are wrapp'd up in it.

8. The *Aurum Fulminans* powder'd along with Sulphur will not explode as usual ; for the Acid of the Sulphur destroys the exploding Principle, and Spirit of Salt has the same Effect ; as also if moisten'd with Spirit of Vitriol or Sulphur, it does not explode.
9. It is observed, that crude Antimony neither vomits nor purges, because the sulphureous Parts are fix'd by the *Clyffus* or acid Salt that is naturally in Antimony ; and to confirm this Reasoning, we find that Antimony is fix'd by Salt-petre, Cream of Tartar, common Salt, Sal Mirabile Glauberi, and other gentle Acids ; and *Mercurius Vitæ*, which some have with greater Propriety of Speech call'd *Mercurius Mortis* for its harsh Operation, becomes purgative by calcining it with *Nitre* or *Sal Gemmæ* and washing, or if we rub it long in a Mortar with common Salt and washing it ; also if to Butter of Antimony you pour in Oil of Sulphur, the *Mercurius Vitæ* corrected subsides ; or if you calcine it with Salt-petre very well, it will be corrected, or if you pour Spirit of Nitre upon it, and then wash it very well ; nay, washing it with Spirit

of Wine, which contains an Acid, will correct it.

10. Antimony is converted into a Butter by Mercury Sublimate with Sublimation ; for the sulphureous Part of the Antimony being lifted up with the acid Spirits that were fix'd in the Quicksilver and desert it for the Antimony ; these Parts, I say, are join'd in with the Acid, and become a Butter ; and the same may be said of any other Butter : for Example, of the Butter of Tin and of Arsenick ; the first being a Sublimation of Tin and Mercury Sublimate, and the latter of Arsenick and the same Mercury Sublimate.
11. Oil of Aniseeds becomes with Oil of Vitriol a Gum or Resin, as does Oil of Turpentine with Aquafortis ; so that upon cooling they may very fitly be made into Pills, as I have often done, proper upon certain Occasions.
12. *Sal Mirabile Glauberi*, which is made from the Caput Mortuum of Vitriol and Salt, or Vitriol and Spirit of Salt distill'd, dissolved in warm Water, filter'd, evaporated, and crystallized, put into Wine or Ale, and set in a Cellar for twelve or twenty-four Hours, will turn the Liquor into an icy Substance.
13. Rectified Spirit of Wine mix'd with Spirit of Nitre and digested, altho' at first they effervesce and raise a great Commotion, yet at last the Spirit of Nitre is corrected by the acid Spirit into a Sweetness ; and this is one of the greatest Instances we have to shew that Oils may be corrected, and softened, and sweetened.
14. Do not the good Women throw common Salt upon Fire when it flames or smoaks, to hinder

hinder both? For what Purpose is this done, but to extinguish them?

From all these *Phænomena* give me Leave to draw the following Corollaries; to wit,

i. It is worth Observation, that Acids of their own Nature are *truly Dissolvents*, if we put enough of them to the Bodies; for as they are the Origin of all Motion, they therefore will dissolve all Bodies, if we make use of the Fire to assist their Action.

And this Dissolution is in a compound Proportion of the Tenacity of the resisting Body and the Activity of the Acid; that is, it is directly as the Concentration of the Acid, and reciprocally as the Tenacity and Resistance of the Body that is to be dissolved; for the stronger is the Acid, the more effectually will it dissolve the Body; but the more solid is the Body to be dissolved, the more strictly are all the Conditions for a Solution to be observed.

So that whenever the Acid is too strong, or meets with little or no Resistance, then the Body is torn to pieces, and its Structure is quite destroyed, or the Body is corroded; where it is not quite so strong, or where the Resistance is much upon a Level with the Concentration, there a Struggle and Commotion ensues; but where the Resistance is too great for the Acid, a *Coagulation* ensues.

Hence may it be concluded, as it is granted by all, that Coagulation is an imperfect or a beginning Dissolution, and Corrosion is a total or perfect one of any Body; and that there is a Semisolution as well as a total Solution of Bodies, appears by all the Instances I have hitherto produced.

But

But that this Affair may appear yet more manifest, I will give some few Examples, where Bodies are coagulated by the Resistance made to the Entrance of the acid Parts, but as soon as this Resistance is removed by Fire, which we all know dissociates Cohesions, and diminishes Attraction, a Solution ensues; wherefore, if we take that Experiment of † *Borellus* under Examination, where he tells us, that if the Serum of the Blood be put over a *gentle Heat*, no Acid will coagulate it: Now we are certain, that any Acid of Strength put to it without Heat, does presently congeal and turn it into a Jelly; and if we boil them together, that is, if Milk and any Acid be put together and boiled, the Milk coagulates in the Nick of boiling into a hard Curd. Again, if you put Juice of Lemons to Milk, the Milk is presently coagulated and curdled, but if you place Milk upon a gentle Heat, and then pour Juice of Lemons upon it, the Milk will not curdle. Nay, if we place Serum coagulated, that is, *Rheumatick Serum*, or Size of the Blood, or the White of an Egg concreted any way, or the *Offa Helmontiana*, over a gentle Heat, they will all be melted, be rendered thin and dissolved.

I will give you one Experiment or more to corroborate this Proof, and then proceed to the remaining Properties of Acids; *Mercury* held over the Fumes of the first Calcination, that is, of Lead that never suffer'd Calcination before, will be fix'd and render'd stark or hard; wherefore, when we have injected Mercury into the Vessels, by holding the injected Vessels over the maiden Steams, as I may call them, of Lead, the Vessels may be discovered and traced to the smalleſt Capillaries, and their minutest Ramifications may be

† *Alphonſ. Borell. de Oeconom. Animal. p. m. 1034.*

taken

taken out and preserved for Ages together. Again, if you take of Verdigrease and common Salt dried, of each six Ounces, of running Mercury or Quicksilver four Ounces; first dissolve the Salt, and then the Verdigrease in Smith's Water, that is, in Water in which Smiths have often quench'd their Iron; then boil these two Salts in an iron Pot, continually stirring the Matter with an iron *Spatula*, till they begin to boil, taking care that it don't boil over; then throw in the Quicksilver, and continue boiling till the Quicksilver flows no longer, but sticks to the Spatula and the Bottom of the Pot like a Glue, which it does in about half an Hour's time; then separate the red Water by Inclination (for if you boil it longer, both the Water and Quicksilver grow black); wash the Mercury with cold Water, and separate the Dregs from it, and put it into any Moulds you please for Figures, Statues, Seals, or such Devices, and in length of time it grows hard and malleable: Some have fancied to make Medals of it, and do pretend to colour it of a golden Colour, or to make it resemble Silver; but the Use I make of this Experiment, is only to convince you, that Acids implicated or entangled by Bodies that resist their Passage, do congeal and take off the Fluidity of these Bodies; but that if their Strength be augmented, or if a greater Motion be given to any Acid, the Body will be corroded: So Spirit of Nitre put to Mercury does dissolve or corrode it.

2dly, *Coagulations do appear to be caused by Acids*; by Coagulations, I don't understand only a bare Inspissation, as when our Serum, for Example, by being placed over a Fire grows thick and gluey, but such an Inspissation as arises from Mixtures, where there is an Interposition of a Body: And as Cold seems to arise from a Mixture of

of a nitrous Spirit in the Air, that coagulates the sulphureous Rays of the Sun, there is no wonder that Vapours should be condensed into Dew, and that these should drop down ; for Cold also destroys Motion, and consequently Heat.

There are *manifest* and *occult* Acids ; our chief Difficulty remains about the latter, the Discovery of which must be found out by the *Criteria* assigned at the Beginning of this Lecture : No one wonders that Spirit of Vitriol should curdle Milk, because we know, that all necessary Conditions being put, Acids do coagulate and incrassate Oils ; but then it deserves Inquiry, why Sack should produce the same Effect.

There are plain Instances of Coagulation in the Blood, abstracting from Inspissation, but whether this happens from any Acidity in the Mass, it has been a Dispute of a long standing ; some affirm, and others deny, that there is an Acid in our Juices : Certain it is, that an Acid has been obtained by Distillation from it, but from what Salt it is gotten, it signifies not, so it has ever been, and can at any time be drawn from it. We swallow a great deal of common Salt ; the Salt obtained by calcining, washing, filtering, and evaporating the Liquor to a Dryness, is a Salt, which being mix'd with Spirit of Nitre, will dissolve Gold ; there is no Salt save Salt Armoniac, Sal Gem, and common Salt, that will do this Feat, wherefore it must be one of these three, but all these three do afford an acid Spirit by Distillation ; wherefore there is an Acid in the Blood.

There is one Circumstance I think necessary to mention in this Affair, because I find few, or rather none, that have observ'd it, namely, that if we take Diet consisting of Acids and volatile Salts, such as Flesh Meats, Sallading, Salt and Vinegar, and Mustard or Pepper really are, we obtain from

our Mass by chymical Analysis, a volatile and a neutral Salt; the first is natural to carnivorous Creatures, and the latter is the Acid more strongly attracted by the fix'd than the volatile Salts: But these are the very Salts we took differently join'd and attracted; therefore Coagulations are Effects of these Acids before their Conjunction with the fix'd Salts of the Blood; and this greater Attraction of Acids to our fix'd Salts than to the volatile, is the Reason why we find so much of volatile Salts in our Blood, and so little of acid and fix'd Salt, but in its stead so much of a *neutral Salt*, which, in other Words, is acid and alcaline Salt join'd together, which here happens to be a fix'd one. This one Consideration, well understood, solves many other Difficulties besides this of the *Scepticks*, who deny that there is any Acid in the Blood; for you are only to join in with this neutral Salt what will attract the fix'd Salt, or, however, what will divide the whole, so as the Fire can come at it, you then gain the acid Spirit as from common Salt, and leave the fix'd Salt behind, which you may get by Lixivation, as usual, at leisure. These being Facts of an undeniable Truth, we may as well deny that there is an acid Spirit in Salt, Sal Gem, or Salt Armoniac, as to deny an Acid in the Blood. Whether *Vieussens* has determined the Quantity exactly or not, I leave it to others to inquire.

The *Modus* of Coagulation may be difficult to explain; it is sufficient for us to know what will coagulate: however, give me leave to indulge my Imagination in this Affair, and when I consider the Figure and Hardness of the coagulating, and the Figure and Softness of the coagulated Body, it appears reasonable to me to affirm, that the Points of Acids do readily find Admittance into the soft and ductile Pores of the spherical Oils, and

and do change each Globule into a Hemisphere, and stick between these complanated Hemispheres, so that they are made to touch in more Points, and consequently to cohere, or be coagulated ; but as I am not positive in this Affair, I leave each Author to explain this Modus of Cohesion as he pleases.

3dly, Precipitation is a natural Consequence of Coagulation ; for where the Oils are rendered heavier by Conjunction with Acids, they become pitchy and subside, and indeed all their Effects are weaken'd, so Oils being apt to turn rancid and stinking, this Smell is destroyed by Acids also : I shall produce my Hearers some Examples of this Kind ;

1. The *Sulphur Auratum Antimonii*, which is made of the Scoriae of the Regulus of Antimony powdered, put into Water, filter'd, and precipitated with Spirit of Vinegar, and wash'd well, or Antimony dissolved in *Aqua Regia*, and precipitated with Water, or of Antimony calcined with Salt-petre, and precipitated with Vinegar.
2. Spirit of Salt will take off the stinking Smell from Flesh, so that it may be boiled and eaten with Pleasure ; or, if you take *Mæbius* his aperitive Tincture made of Spirit of Salt one Pound, Salt of Tartar half a Dram ting'd with *Turnsole* ; this Tincture will have the same Effect ; and this is a very useful Method for the Victuals of Sailors.
3. Spirit of Vitriol precipitates the Sulphur out of the Tinctures of Sulphur or Antimony, as Spirit of Nitre throws down Benjamin from its Tincture, if you make use of a small Quantity of it.

4. By the Acid of the Air as well, though not so quickly, as by Spirit of Vitriol, is Wine precipitated into a Sediment.
5. The Tincture of *Brasil* Wood, which is made by infusing and digesting this Wood in any *Lixivium*, Gum Arabick, and a little Alum, is precipitated by Spirit of Vinegar, so that the Red changes into a yellow or amber Colour.
6. It is a common Experiment to precipitate new Beer, which is muddy, and not at all clear, by a little Alum, Vitriol, or Sugar of Lead, into a transparent Liquor, and this makes it drinkable in a Night's time.
7. Apothecaries, whose Waters are foul, and the same is said of foul Arrack, and other foul spirituous Liquors, throw in Alum, especially burnt Alum, or calcin'd Vitriol to fine them.
8. A Decoction of the Bark of Peru is muddy and whitish, and if you have a mind to rob it of its resinous or oleous Parts, you throw in Oil of Vitriol, and by filtering it becomes transparent; and if you have a mind to make it muddy again, you need only put in a little Spirit of Hartshorn: And the Reason of the Precipitation is, because the Acid makes the Oil pitchy and heavy, and therefore throws down the oleous Parts; and the Reason of the Restitution of its muddy Colour again is, because you will perceive in the Progress of these Lectures, that Oils are rendered thin and light again by volatile or fix'd Alcali's, which destroy the Effects of the Acids: Nay, if common Water, as it frequently is in *London*, be muddy, mix any Acid with it, as Lemon, or such like, and filter, and it will become clear.

9. Spirit of Nitre precipitates Butter of Antimony, and therefore it is oleous, which is confirmed by its giving a Tincture to Spirit of Wine.

Fourthly, *Acids are precipitated or corrected by Alcalines, (and vice versa, as shall be said in its proper Place) but if too much Acid be in any Body, then the Alcali that did precipitate is resorbed and suspended.*

1. If Salt or Oil of Tartar be put into Water, and you drop a few Drops of Spirit or Oil of Vitriol into the Mixture, it grows muddy, and in process of Time will be thrown to the Bottom ; but if so much of the Oil of Vitriol be thrown in as to make the Liquor heavy with it, then it becomes clear again in the same manner as Salt will precipitate Quick-silver out of Spirit of Nitre ; but if the Water be made too heavy with the Salt, the Mercury will be as well suspended by the Salt as the Spirit of Nitre : But whether this Resorption depends upon the Weight of the Acid, or upon a Corrosion of the Alcali, or upon both together, I shall not determine ; only as they do separately answer, when both Causes concur, we have reason to believe that both Causes do act. In the same manner, if Spirit of Vitriol be poured on the Tincture of Salt of Tartar, there is a Precipitation, and the Mixture becomes turbid and opac ; but if more of the Spirit be added, it becomes clear again.
2. If you take Flowers of Tin, which are made, either by detonating with Salt-petre, or with Salt Armoniac and Subliming, and put upon them, dissolv'd in Water, Spirit of Salt

Salt Armoniac, you presently get the Magistry of Tin, because the volatile Spirit throws down what the Acid had dissolv'd.

There is one Remark which ought to be repeated here, namely, that Acids do attract fix'd Salts more strongly than they do volatile ones; which is the Reason why, in making the volatile Salt or Spirit of Salt Armoniac, the Acid in the Salt Armoniac fixes upon the Lime or Salt of Tartar, and lets go the volatile Salt, which therefore in an Instant flies up into the Air or the Receiver, and strikes our Nostrils; and therefore, when any Precipitation is to be made by either of these two Salts, you will obtain more by the fix'd than the volatile, if the Precipitant be of any Value, of which those Artificers should be appriz'd who work in Metals of high Prices: And in this second Paragraph, we see the Acid forsakes the volatile Salt of the Salt Armoniac, and fixes upon the Tin; as in the like Instance of making *Flowers of Salt Armoniac martiated*, the Acid of the Salt Armoniac fixes upon the Steel, and the volatile Salt mounts coloured, and that it is volatile Salt that ascends, we discover by the Smell.

Another Observable occurs to me concerning *Camphire* and *Myrrb*; we know, by *Analysis*, that *Camphire* is an oily volatile Salt, and that *Myrrb* affords an acid Spirit; these two Salts in mixing the Gums in a Mortar attack each other, and grow moist by their Action, upon which the Bodies grow pulpy, and may be made readily up into a Mass of Pills, which are as truly Hysterical as any one Composition in the whole *Materia Medica*.

Thirdly, *Acids effervesce with pure Alcalines, but these do not buff with mix'd Acids ; for Example,*

1. *Tartarus Tartarisatus, or Samech Paracelsi, or Tartarus Solubilis, is made by pouring on to Tartar dissolv'd in boiling Water, Oil of Tartar per Deliquitum, gradually, the Salts do buff and effervesce egregiously, and swell greatly, and a Spoonful purges.*

N.B. These Salts don't effervesce in cold Water, because the Tartar is not dissolv'd in cold, but hot Water, and there is no Action in Salts till they are dissolved.

2. Acid Spirits effervesce and boil up with Spirit of Sal Armoniac, or with any other volatile Spirit.
3. Spirit of Nitre huffs with *English Talc* or Sparr, with Egg-shells, and all testaceous Drugs, such are Crabs-Eyes, Coral, Pearl, and the like.
4. Butter of Antimony effervesces with Salt of Tartar, by reason of the acid Spirits the Butter has in it.
5. Cream of Tartar huffs with Spirit of Salt Armoniac.
6. *Irish Slate, called Lapis Hybernicus, huffs with Spirit of Hartshorn.*
7. Oil of Tartar effervesces or boils with Crabs-Eyes, by reason of the Acid of the Air contained in this Oil.
8. But *Spiritus Nitri Dulcis, or any other acid Spirit dulcified, does not buff with Spirit of Hartshorn or of Salt Armoniac.*

Fifthly, *Acids having dissolved Bodies in Liquor, and Alcalies having precipitated them, the Precipitate is again resorb'd into the Liquor, by pouring on more Acid.* For Example,

1. If you pour on the Infusion of Galls or Green Tea to chalybeate Waters, they immediately turn Purple, but if you pour on Juice of Lemons till the alcalious Salts of the Galls or Tea are corrected and destroyed, the Liquor becomes clear again ; and this Precipitation and Resorption is practised on a ludicrous Occasion ; for Example, you take Vitriol or *Calcanthum*, and Galls in Powder, and strew them upon a Towel, so that no one shall discover it, as soon as any one has washed themselves, and taken the Towel to wipe their Faces, where-ever they wipe, the Part becomes inky, but is soon taken away by putting in Juice of Lemons, or any Acid into Water, and washing with this Mixture, and wiping it with a clean Towel.
2. If Mercury sublimate in Water be precipitated into a white, red, or yellow Precipitate, you may render the Liquor transparent again by pouring in enough of any acid Spirit.
3. If you dissolve *Saccharum Saturni* in Water, and precipitate it with Salt or Oil of Tartar, you make the Liquor clear again with Spirit of Vinegar, or indeed, with any other acid Spirit.
4. Red Wine is made of that Colour sometimes with Extract of Steel ; if so, it is readily discovered by putting in some few Drops of Oil of Vitriol, which resorbs the Iron, and then the Wine which was sophisticated, and to which a false Colour had been given, becomes white, and discovers the Cheat ; for

as the Vitriol was only some Raments of Iron mix'd with an Acid, and precipitated with the Steel, so the Acid resorbs that alkalious Part, and the Colour, which depended upon this Mixture, vanishes.

5. The Tincture of *Lapis Hybernicus*, or rather the Infusion of it in Water, grows black by scraping Galls into it, and grows clear again with Spirits of Salt or of Nitre, or any other acid Spirit : This Experiment demonstrates this Stone to be a martial one, to be therefore styptick, which colours with Galls, but is clear'd with so much Acid as will destroy the Galls.
6. *Mercurius Dulcis*, which is a Composition of Mercury sublimate and Quicksilver blended together and sublim'd, and is therefore a weaker Vitriol than Sublimate, by having fewer of the acid Spirits, Bulk for Bulk, than Sublimate has, is precipitated into a black Colour by Spirit of Hartshorn, but is return'd to its Whiteness again by pouring on as much acid Spirit as will absorb the volatile Spirit.
7. Let Mercury be dissolved in Aquafortis, or in Spirit of Nitre, and be mix'd with Fountain Water, it will be precipitated into a Black, or rather Grey, without the Water, but with it into a White ; by Salt of Tartar into a Brownish or Yellowish ; by Salt of Tartar into a milky ; by Lime Water into a yellow Colour ; and by Spirit of Salt, or common Salt, into a White : If in lieu of common Water you pour on Lime-Water, a Yellow is precipitated. In like manner, if Sublimate be put into Water and dissolv'd, it will be precipitated by volatile Spirits or Salts into a White ; by fix'd Salts or Oil of

of Tartar into a Red ; and by Lime-Water, into a Yellow or *Turpetum Minerale* ; and even the Red becomes White after Precipitation, with Spirit of Salt Armoniac : The Red is said to be doubly stronger than the White ; the White doubly stronger than the Yellow ; and the Yellow is the weakest of all. The White being bedewed with Oil of Vitriol, and reduced into a Paste and dried, this Operation being thrice repeated, and the Matter being wash'd with Water till it licks up the Acid, then five or ten Grains will purge gently : Now all these Precipitates may be clear'd again by pouring in Oil of Vitriol, or any strong Acid. There is mentioned one Exception, and that is in *Turpetum Minerale* ; if Mercury be dissolved and precipitated by Oil of Tartar, it may again be dissolved by Spirit of Salt, but cannot again be precipitated by Oil of Tartar ; but this does not hinder its being precipitated by Spirit of Nitre or Oil of Vitriol ; the Reason of which is, that the Cohesion between the Spirit of Salt and the Mercury is too strong to be thrown down, whereas the others are more potent Precipitants of Spirit of Salt, as has been observed above. Moreover, if Mercury be dissolved in Aquafortis, and committed to the Fire, and evaporated to a Dryness, it is a red Precipitate ; but if to this red Precipitate you add Spirit of Salt, it is a white one, because the Spirit of Salt precipitates the Spirit of Nitre, but to either of these add another Dissolvent, and it will be resorb'd, that is, as Oil of Vitriol dissolves red Precipitate, that will resorb it. And in general, it is to observed, that red Precipitate suffers the same Changes as Quicksilver,

except that Quicksilver is not dissolved in Oil of Vitriol without boiling ; and red Precipitate reforb'd by Oil of Vitriol, or Spirit of Salt, follows the Salt of Quicksilver dissolved in *Aquafortis*.

8. If to Vitriol you put Spirit of Salt, you gain a golden Tincture ; but if to Steel you pour on this Spirit, you gain a green one ; but both are precipitated by alcalious Salts, such as Salt of Tartar or Spirit of Hartshorn, and you again return the Tinctures with the acid Spirit.

N. B. This is one good distinctive Mark to know whether Iron be contained in any Glebe.

Sixthly, *Acids are amicable Specificks, where they are wanted, and by Consequence are indicated.*

Seventhly, *Acids do binder the Production of elastick Particles.*

But this seems to retain to the coagulating Property of Acids ; for if they arrest Motion, as Cold, Vinegar, and such like, they hinder Fermentation and Collisions, and Air is produced by such Attritions : Hence Mr. Boyle tells us, that strong Beer is less elastick than common Ale, and contains less Air in it ; and common Salt by its Acid hinders Eggs from corrupting ; but if there be enough of a concentrated Acid, then necessarily ensues a Motion ; for Oil of Vitriol turned into a dry Salt, effervesces like Water with Lime or concentrated Oils.

Eighthly, There are various Methods of correcting Acids ; for Example,

1. *By Fire*, for if you put an Iron red hot into Oil of Linseed till it ceases to boil, shutting the

the Orifice of the Vessel, lest it flame, you destroy the Acid.

2. By throwing in Lime, Chalk, or any alcalious Body into it.
3. By distilling from Colcothar or Bricks, and then it mounts thin and clear.
4. By washing the Body that retains it and holds it fast with warm Water.
5. By Spirit of Wine rectified, and burning it away, so red Precipitate is rendered mild, and becomes *Arcanum Corallinum*, or *Pulvis Principis*, by moistening it with Spirit of Wine and burning it, and by repeating this Operation five or six times over.
6. By Tincture of Sulphur, for washing the Body with this, and burning or not burning, you take off the Acid.
7. By crude Mercury, for Sublimate becomes *Mercurius Dulcis* by adding Quicksilver.
8. By Sulphur, its Flowers or its Milk, for these obtund Acids.
9. By a gentle Digestion.
10. By precipitating with contrary Bodies, that is, with alcalious Salts, such as Coral, Chalk, Spirit of Hartshorn, volatile Salts, and fix'd Salts.
11. By Distillation from Spirit of Wine rectified, so red Precipitate is made gentle by this Method, as it does with burning it upon it.
12. By Sublimation, so red Precipitate becomes milder and weaker by Sublimation alone.
13. By Calcination long continued, till no further Smoak appears; hence red Precipitate, the more it is calcin'd, the less corrosive it is.
14. Camphire and Turpentine obtund any Species of Acrimony; for *Turpetum Minerale* blended in equal Quantity with Camphire,

becomes an Alterative, and *Vitriolum Album* proves a Diuretick if mixed with Turpentine; and *Camphire* even obtunds *Cantharides*, which all know to be a burning acrimonious Insect, because, as I have observed above, *Camphires* contains a butyraceous Oil; and it is observed, that Crystals of Silver are Caustick, and are not to be given internally, unless they be mixed with Gums or Pills.

Give me Leave, before I dismiss this copious and agreeable Lecture, to subjoin a few Observables upon Acids, which do not readily fall under Rules.

1. Spirit of Salt has somewhat peculiar in it, namely, that whatever Bodies it dissolves, it renders those Bodies very fluxile, and it makes the Calces of Metal so fusible, that they will flow afterwards like Wax at the Fire; this principally appears in the *Luna Cornua*, which is Silver dissolved in *Aqua-fortis*, and precipitated by Spirit of Salt or Salt itself; or it is made of the Crystals of Silver made by Silver dissolved in Spirit of Nitre, and evaporated to a Pellicule, and then calcin'd with Spirit of Salt, it runs at the Fire like Wax, and dissolves in Spittle: It has the same Effect upon Quick-lime, which will not fuse upon the strongest Fire, but if you dissolve it in Spirit of Salt, and make a Magistry of it, by drawing off the Spirit with Evaporation, then the Lime will flow at the Fire like Wax.
2. There is a fix'd and a volatile Acid; for Example, if you keep Lemons or Oranges for any time, they lose their Pertness, and become pall'd or dead; or if you distil

Elder-Berries, the lively acid Spirit mounts up, and leaves the acerb or pall'd Acid at the Bottom of the Retort: In the Stomach there is a pert Acidity, but in the *Colon*, where the Colicks take up their Seat, the Acid is more earthy and acerb; the pert Acid is generally lightest, so Spirit of Vitriol is perter than the Oil: And in making Vinegar, if you suffer it to evaporate too much, you obtain nothing but a vapid Sour.

3. As Acids, especially those made by Fire, are continually in Motion, the most effectual Method to hinder this Avolation is to keep them cool, for Cold hinders Motion.
4. Acids the most fixed by frequent Cohobation become volatile; therefore no Acid is properly fixed, but is made so by its Adjuncts, which hinder Avolation.
5. In Rectifications of Acids, first comes the aqueous Acid; 2dly, the Vinegar; 3dly, the ponderous Acid, and the more Water we call off from any Acid, the stronger will the Acid be: Hence,
6. In the Distillation of Tartar, first comes the aqueous; 2dly, the acid Spirit; 3dly, the Oil; first the thin; then the grofs; and then remains at Bottom the fix'd Salt.
7. Distill'd Vinegar has an Oil in it, because it is the Acid of a Vegetable, but the Oil of Vitriol, or the Spirit of Nitre has none, being distilled from Minerals.
8. Acids may be destroyed or fly off; hence *Mercurius Vitæ calcin'd* does not vomit.
9. All Vegetables whatever, even the volatile ones, of Scurvygrass, and the like, have an Acid in them; hence Bread and Extracts afford an acid Spirit.

10. If Earths be join'd to Acids, they don't readily ascend in Distillation, because these two attract each other closely.
11. We may discover Spirit of Salt, by its turning red Precipitate white.
12. Spirit of Nitre is the Crystals of Salt-petre join'd to a little Water, and hence if Spirit of Nitre be join'd with Spirit of Wine and distill'd, the Crystals remain at Bottom; and this proves Acids to be hard Bodies.

Having thus given a large Detail of the Properties of Acids, it behoves me now to account for their Effects produced on human Bodies. And

First, By the Solidity of Acids, they are capable of pushing their Way thro' the softer Bodies, and therefore they enter into watry and oily ones, and mix with them; and by their acuminated Figure they *prick, cut, corrode, and irritate.*

From hence we can reason mechanically upon some of their Virtues; for *hard Cones* act in a *Ratio* to their Powers and Resistances, and as Wedges enter Bodies we are to consider what is the impelling Force that drives these Salts into the very Bones themselves; we know none, save the Force of the Circulation which depends on the Force of the Heart; when therefore this Force is to the Resistance of the Flesh or Bones as the Thickness or Base of the conical Salts are to the Lengths, there can be no Action; but if the Force of the Circulation be ever so little augmented, or the Lengths of the Salts be greater, then there is Danger of their penetrating even the Bones themselves; and hence are some Diseases apt to corrode the Flesh, whilst others corrupt the Bones.

We see then why these Acids of a concenter'd Nature are made use of to corrode *Fungus's* or *Caruncles,*

Caruncles, and by this irritating Power they kill Worms, prove diuretick, and are Expellers of the Stone: From this same Property they become hurtful in Pains, Coughs, Stranguries, Tenesmus's, and Vomitings.

As no Acids are without Earth in their Composition, therefore do they corroborate, astringe, contract, and cicatrize, and are therefore used in Fluxes and Hæmorrhages.

As we view them in another Light, namely, if we consider them as acid earthy Bodies acting jointly, then they will corrode first, and next dry up or cicatrize, and may be used in putrid Ulcers that are difficult to be cured: In this last View we find that if Spirit of Salt be gently rubb'd over a dysepulotick Ulcer, or, in other Words, over an Ulcer that won't heal up, it first corrodes the fungous or callous Lips, and then it heals up the Ulcer; this has been often try'd with Success, where Surgeons meet with Ulcers that are stubborn.

However, there is one Caution to be observed in the Use of such irritating Salts, which is this, that where these stimulating Parts do more Dis-service than their earthy Parts do Good, we must forbear their Use.

They being small and solid do readily enter into the flexible Parts, and into the Interstices of our Fibres, and by these Means do cause a Stimulation and Pain, and if they be pure Acids, as the acid Spirits are, they enter the Pores in Sheafs, and the Heat of our Bodies moves them from Side to Side, so that by this Motion they prick and cut like Daggers; hence we can never give above two or three Drops at most of the stronger Acids, and then they must be very much diluted, or they will prejudice the Parts: *All Salts whatever do stimulate, but these the most of any.*

As to the Modus of Earths contracting Fibres, I shall speak of it when we come to the Lecture upon that Head.

Secondly, *They attract Water and are dissolved in it*, because they attract it more strongly than they do themselves, and therefore they recede from each other, and are diffused thro' the Water: Hence are Acids diluted and corrected, as I have observed, by watry Liquors, and in any saline State, Diluters are always useful: Hence when poisonous Acids have been taken down, *Water* warm'd is one of the best Vehicles to weaken their corroding Force, because it dissociates them.

Thirdly, From Oils and Acids raising such Struggles together, it appears how our Blood is hot upon Motion and Collision of heterogeneous Parts; this Heat promotes our Chylification and Sanguification, and as all Heat is in a Ratio of the Density of the Particles that cause it, so they who live upon a Vegetable Diet are less apt to irregular Commotions, they who live upon fermented Liquors have yet more, because the Particles are more concenter'd and pure, and when they occur, they are fit for raising Effervesces; but they who live medically are apt to suffer great Alterations; we frequently observe some Persons to be very subject to Flushings, when they take Vinegar or drink Lemonades, and this is mostly in saline and biliary Constitutions, for then it effervesces as soon as it arrives in the Blood: Heat is an Effect of Motion, and Motion depends upon contrary mechanical Affections in the different Matters: Such therefore as are of that Constitution will be heated by these Salts for a while.

Fourthly, As concenter'd Acids do corrode Oils, and even Bones, we know the Danger of insisting too long upon such Remedies, and our Blood

Blood being render'd corrosive from them, it would be equal to the Scurvy or the Venereal Disease to insist too long upon them: Acids are Medicines capable of producing fainous and carious Ulcers, Leanness, Consumptions, and putrefactive Diseases; all Acids whatever will in Process of Time generate these Disorders, because it is an easy Transition from a depress'd acid State to a corrosive one; for the Acid by many Circulations becomes extricated, and as it abounds in the Blood, it neither has left volatile or fix'd Salts or Oils with which it has not join'd, so that it predominates and turns at last corrosive, and preys upon the Flesh and the Bones also, and destroys us.

Fifthly, These Acids in small Quantities, where the Oils are crude, or even where there do arise Effervescesces, do coagulate Oils, that is, where they are not sufficient to penetrate thro' the Body, they link 'em together, and produce Cohesions and Coagulations: In such a Case they cool us, by arresting the Motion of the Fluids; for *Fluids, so much as they lose of their Fluidity, so much do they lose of their Motion*: We see this experimentally try'd in Carcasses, where pickling them with Acids, they never smell, at least for a considerable Space. From this Paragraph, it may be known why we make use of Acids in ardent Fevers, where the Blood moves excessively both in its Circulation as well as in its intestine Motion; by giving Lemonade, gentle Acids, or even acid Spirits well diluted, we arrest this Hurry, and the Patients fall into Sweats, and the Fever terminates; it may be esteem'd a Paradox, that these Acids will cause those in Fevers to sweat, and yet will suppress Sweatings in others; but if we consider, that there is a certain specifick Degree of Motion required in each Person to produce Sweat-

Sweating, which if too high or too low will not succeed, then it follows, that by depressing that Motion to certain Degrees, with the same Remedy we can make Patients sweat, or cause them to cease at Pleasure. If we put a Stop to the Causes, we cut off all the Effects; wherefore as excessive Motion is the Cause of Putrefaction, we check that by Acids; and as Coma's from ardent Fevers are occasion'd by the excessive Distension of the Blood-Vessels of the Brain pressing upon the medullar Part of this Organ, so the Blood is brought into a narrower Compas by these gentle Acids, and Coma's are cured thereby; and as Hæmorrhages are produced from too great Expansion of the Blood, and an opening of the Vessels thereby, the same Acids do cause this Expansion to cease, and then the Vessels close of themselves: *Bilious Colicks* are caused by the sharp Salts of the Bile, that fret the Intestines, and as these Acids are of a different Genius, they join in with them, and make a mild Compound, which we call a *Sal Enium* or neutral Salt, or these Acids join in with the volatile Oils, and make a *Tertium Quid* of a mild Nature. *Thirst* is an Effect of Heat and Motion exhaling the Spittle to a Crust, and causing an *Idea* of the Want of Liquids, and as Acids in a small Quantity, especially the natural ones made without Fire, do extinguish Motion, they abate Thirst. *Hecticks* are assisted by them from the same Principles; for Heat depends on Motion and Attrition between contending Particles, which these Acids do allay. Vomitings do often depend upon the Bile irritating the Stomach, and these Acids unite with them and mitigate their Fury, so that the Fibres of the Stomach cease to be irritated as usual. Wine and winy Liquors inebriate by reason of their active and oleous Parts, and these gentler Acids do curb and

and check these Commotions, so far that if we would prevent Drunkenness, or take it suddenly off, a Draught of Vinegar will effect it. Lean-ness depends upon an Avolation of the nourishing Particles, which are retain'd by taking four Things, their Flight is retarded, and the Oils are kept in a State of Implication: They have been observed to abate the Fury of Lust, and *Langius* tells us, that Spirit of Vitriol being long continued in small Quantities has reduced the *Testes* into a very small Compafs, and destroyed Virility; and if we consult Authorities, we shall find it affirm'd, that Sugar of Lead, or, which is much the same Thing, *Acetum Lithargyrites*, tho' *Ettmuller* denies it, abates Venery, and poisons slowly; and I know not why small and four Punch, which too many admire, may not have the same Effects; and all these Feats are done, because *Acids incrassate Oils*.

From these Hints we are led to know why hysterick Women are prejudiced by Acids, as also hypochondriack and splenetic Men; as also why Convulsions are increased by them, or indeed why any Disease depending or supposed to depend on Acids, are hurt by their Use; since if the Blood is too eager already, any Addition of that Quality must injure.

From this Quality of incrassating or obtunding Oils, we preserve Bodies with Acids from Smelling, and therefore do we imbalm with them.

From the Power that *Acids have of precipitating Alcali's, and the contrary*, we do readily conclude, that Acids are powerful Remedies against alcalious Poisons; so Cantharides, Hellebor, Lime, and many others, are corrected by them, and an alkaline State of Humours yields to them prudently administer'd; Vomitings proceeding from an Acrimony of the volatile Kind fretting the Stomach,

Stomach, are allay'd by two or three Drops of Oil of Vitriol given at proper Intervals, this will turn the caustick Salt into a neutral one of a mild Nature, and into one similar to the natural Secretion ; it is sometimes required in these Cases to avoid any Commotion or Hurry, and therefore in the scorbutick and hypochondriack Cases we administer such as will raise no Effervesences, but I understand that Scurvy which proceeds from a saline State : They raise the Appetite of such who have lost it by an alcaline State of Humours ; for there is a certain Degree and Manner of Stimulation required, and as one too alcaline or too acid does not effect it, a neutral one is natural, and therefore in this State is it supply'd by Acids ; we cannot want Instances to convince us how Acids and Alcali's are contrary to each other, and how much the late Practitioners, especially in *Sylvius's* Time, built upon this *Theory*, where all Diseases were professedly deduced from an Acid, and one Remedy was to do the Cure ; witness *Blancard's Idea*, in which small Treatise every Disease is explain'd to proceed from an Acid, and one Species of Remedy is cry'd up for the Cure ; witness *Muys's Surgery*, who treads in the same Steps, and with great Gravity thro' the whole Book applies Remedies that are alcalious, or at least according to his Notion are such, so that in that System of Physick the Gentlemen of the Faculty had but one View to answer, and all Diseases, that were curable, were to vanish : Hence may we conclude the Danger of curing by *Hypotheses* which have no Foundation in Nature ; these have always been, and ever will be the Bane of the Profession ; none of which have ever served our Turn separately ; nay, the mathematical and chymical themselves disjointly will not answer our Ends, which, however,

ever, join'd together will adequately answer our Ends.

From their being *amicable Specificks*, we see the Necessity of giving them in such Cases as they are wanted, and as the Ferment of the Stomach is said to be an Acid, where-ever that is wanting, as in Drunkards it often is, because they wash it off from the Pleats of the Stomach, then will it be convenient to administer them to restore this Stimulant. For this Purpose therefore we find Authors recommending Quinces, Spirits of Vitriol, or Mastick, *Paracelsus's Elixir Proprietatis*, and *Hartman* commends the *Philosophical Spirit of Vitriol* for this End, which is got after the Precipitation of *Mercurius Vitæ*; for you keep all the Waters remaining from the Precipitation and Lotion of it, and mix them together and evaporate them to Two-thirds, and you get this Spirit, which is only the acid Spirits that had made the Butter of Antimony, detach'd into the Water and regain'd, of which you make a Gas by Evaporation.

Thus have I given you a general Account of their Virtues; I shall therefore descend to the Individuals most in Use at this Time, and what Physicians use them for; altho' it may, by what is said, be readily guess'd how the particular Drugs act, yet we enter into a Detail to shew our *Auditors* Authorities for our Assertions.

Fructus Cerasorum Nigrorum, (*Black Cherries*); they are reputed cooling, and as their Water is also tartish, it has so far the same Virtues; in making Black-Cherry-Water, they bruise Cherries and Kernels in a Mortar, and the Cherries die the Hands of a black Red, to take off which Colour the Apothecaries use Oil of Vitriol in Water to wash their Hands with, this Lotion turns the Black into a pale Red, which washes off gradu-

ally ; this shews the Red to depend upon some saline or nitrous Acid derived from the Soil into the Fruit.

Fructus Fragrarie, Uvarum, Grossularum, Ribes, (or Strawberries, Grapes, Goosberries, Currants), they are cooling, quench Thirst, give an Appetite, and allay the Heats of Fevers ; for the acid Salts being few, and implicated or entangled in a great many gross Oils, they are moved gently along, and resist Motion, and therefore we are cool'd by them ; as the Salts that occasion Thirst are such, by which the Blood is agitated, and then the watry Parts fly off and leave a Dryness, so these temper those Salts, and the thin Parts are retain'd ; to an Appetite is required a certain Degree of Stimulation, which these Acids do furnish us with ; and as Fevers depend upon an Increase of Motion, and Acids check it, they are reputed good in them.

However, one thing must be regarded in the Use of Fruit, namely, they who use them plentifully are apt to fall either into Cholera's or Fluxes, and Fevers, the Reason of which appears from the Experiments which we have brought ; for when the Heat of our Body has exhaled the watry Parts from them in the Form of Belchings and *Crepitus*, the Oils and Acids contain'd in the Fruit begin to approach each other, and to effervesce and ferment, and to stimulate the Intestines, and then they raise Discharges ; or the Arteries, and then they produce Fevers ; these Effects would not be credited, if every Year's Experience did not give us Examples of it in *August*, in *England*, when the Bills of Mortality are hugely increased, from the Numbers that die of Cholera's from a too plentiful Use of Cucumbers and Fruit putrifying in the Bowels of their Devourers ; and when an *English* Army quarters in *Spain* or *Portugal*,

tugal, what Hayock don't the new Wines and Fruit, the Soldiers devour so unmercifully, make in our Army? And these very different Effects are deduced from the Properties of Acids, to wit, the first of cooling from Property the 3d, and the latter from Property the 1st and 2d.

Ribes Folio Nigro, (*black Currants*), are reputed diuretick, and this is the Reason why some infuse them in Wine as good against the Stone; small Stones demand Diureticks, but great ones must not be moved; so that in Gravel and small Stones this is a good Diuretick, because they irritate, as being Acid; but then they have another Quality, namely, a Sweetness, by which they lubricate the Passages, and hinder the Adhesion of Stones to the Walls of the *Pelvis* or to each other: They are also used to cool us in Fevers, and to give an Appetite; the Pulp of this Fruit might be preserved for the Purposes mention'd, and in other Countries a *Rob* is made of all these Fruits and Berries.

Mala Aurantia, Limonia, Citria, (*Oranges, Lemons, Citrons*), they cool, are stomachick, and antifebrile; where the Stomach has a burning Heat in it, they refresh it; and in pestilential Fevers of the ardent kind, or in any acute Fevers, they allay the Heat and quench Thirst, and prevail in Syncope's, or any Symptoms proceeding from this Heat.

Folia Acetosæ, Acetosellæ, Lujulæ, (*Sorrel, Wood-sorrel*), they cool, appetite, are diuretick, and antifebrile; the Fevers these are used in must be of the ardent sort, in which they allay Thirst in Decoctions; in bilious Constitutions they serve as Sallading to cool them; and in Jaundices proceeding from too great a Redundancy of Bile, they are of Use; and in all Symptoms arising from Bile, such as Head-achs, they are beneficial;

hence also in any erysipelatous Constitution, they are of great Use; also in Swellings of the soft Parts, as in Quinsies, they serve to make Gargles to allay the Tumour.

Cydoneum, (Quince), it strengthens the Stomach; Quinces are used in Fluxes of the Belly, such as Diarrhoea's and Dysenteries, because they bind moderately, therefore in such Cases we often order our Patients to refresh themselves with the Marmalade made of them: The Marmalade is also much used in Persons subject to Vomitings depending upon bilious or choleric Humours.

Acetum, (Vinegar), it cools much; it may be used in Fevers of the ardent sort; outwardly it repels, and is used in lax Tumours for that Purpose: It is reputed good in Swoonings, proceeding from a Dissolution of the Blood, where the Blood swells and distends the Vessels, which happens in the bilious and saline Constitutions: It is used in Sauces to cool and refresh. Vinegar distill'd affords Acid and an Oil, as well as a great deal of Water; reduce the Coal left after Distillation into Ashes, lixiviate, filter, and exhale, it becomes a Salt fit to absorb Vinegar again: Evaporate Vinegar to one Fourth, and the Remainder is distill'd Vinegar. It often contains Worms. The distill'd Vinegar is a stronger Acid than Vinegar, and is used in Spittings of Blood, and it is also used in Vomitings of the same; it affords Brandy upon Distillation; for Sugar of Lead, which is made of Lead and Vinegar, affords Brandy, and the Lead melts down into Metal.

The *Posca* of the Antients, which is only Vinegar and Water, is used internally to cool, and externally, that is, in Glisters, for bilious Colicks.

Honey tempers the Sour, but too often taken it gripes, and therefore *Oxymel* is no agreeable Medicine.

Tamarindi, (Tamarinds), they cool, quench Thirst, correct biliary Humours, and are also laxative: It is used principally with us in *England* to put into the Mouths of Patients sick of Fevers, for allaying their Thirst, and also in Decoctions with Purgatives.

Some have advised its Tartar, for all Acids may be crystallised, to raise an Appetite.

Baccæ Berberum, (Barberries), they corroborate the Fibres of the Stomach, and serve to raise an Appetite; they quench Thirst in Fevers of the ardent kind, and in this Case their Rob or inspissated Juice is often kept for this End; we in *England* pickle them for common Use in Diet; and some Chymists make a Tartar of them for giving an Appetite.

Baccæ Sambuci, (Elder-berries), they are diuretic, and the Dutch make a Rob of them for this Purpose; they afford an acid Spirit in Distillation; they are made into Wine with Raisins.

Oleum, Spiritus Vitrioli, (Oil, Spirit of Vitriol), is good in Fevers, and Hæmorrhages; but much of it extinguishes Venery; it dies the Teeth yellow, and therefore 'tis bad to clean them with it. The Spirit appears not to be a true Acid, for if you pour on any Alcali to it, it precipitates a metalline Substance; it turns blue Flowers into a Red, as we see in Turnsole, and red ones into a red Colour, as we see in making Tincture of Roses, which turns not red, tho' the Roses be boil'd in Water, till this Spirit is pour'd on. Its Effluvia turn Things white, and its Spirit precipitates Urine: If Spirit of Vinegar has dissolved Coral, or any other testaceous Medicine, the Spirit of Vitriol will precipitate the Coral, according to what is observed above. If you dulcify the Spirit or Oil of Vitriol with Spirit of Wine, it is still cooling, appetising, and styptic; and to make

Conserve of Rosēs more styptick, we pour on a few Drops of Spirit or Oil of Vitriol upon it, and then it is call'd *Conservā Rosarum Vitriolata*, and it is given in inveterate Fluxes. The Oil being caustick, it is referr'd to that Head, but it may be used to two or three Drops in any Vehicle in Vomitings, according to *Rulandus*; and his Method was to give *Vin. Malvatic*, (Currant Wine) ʒvj. *Ol. Vitriol. Roman.* gutt. vj. in a Morning fasting. The Oil serves as a good *Hygroscope* or Measure of the Moisture of the Weather; for if it be exposed to the Air, according to the Moisture that is in it, it grows proportionably heavier; after which, if the Air grows dryer, it grows lighter; so that if you put so much Oil of Vitriol in one Scale, and its Equivalent of Weights in the opposite one, you will have the Pleasure to see it rise or sink, as the Weather is dry or wet. The Oil dissolves, as I have said, Bread, Zink, Antimony, Sal Gem, and Lapis Calaminaris; it makes Water hot, and dissolves Ice, and yet will extinguish Fire; so that a good Quantity ought to be carried to Sea, in Case of Accidents.

Spiritus Sulphuris, (*Spirit of Brimstone*), it is stomachick and pectoral in certain Cafes, where the Blood is too much rarefied; it coagulates Milk, Serum, and Oils, contrary to the Opinion of some, who have never try'd Experiments; the strongest Spirit is call'd *Oleum Sulphuris per Campanam*; it, like all other acid Spirits, turns blue Flower's into red; Dr. *Willis* affirms it not to differ from Oil of Vitriol; but we ought to be cautious in affirming what we are not sure of, since it is evident how great Difference there is between Acids and Acids.

Spiritus seu Oleum Salis, (*Spirit or Oil of Salt*), it is cooling, and therefore it is used in Fevers; it provokes

provokes Urine, and is therefore used in Suppressions of it, and in expelling the Stone; it creates an Appetite, in such as have debauch'd and have wash'd off the Ferment by Morning Draughts. We use it to cure rotten Gums in scorbutick People; and in Fordid Ulcers there is not a better Remedy; for if you apply two or three Drops, according to the Size of the Ulcer, that runs a great deal of fanious Matter, and is hard to cicatrize, I have observed them to yield, and be cured soon after; if you pour on a Quantity of Spirit of Salt to Lapis Calaminaris, it loses its Acidity, and it becomes a tasteless Liquor; hence Lapis Calaminaris is given to absorb Acids in Dysenteries; but here *Ettmuller* deceives his Readers, for the Liquor becomes very acerb; not but that Lapis Calaminaris does absorb Acids, or if you please to evaporate the Moisture, that which evaporates is tasteless and Phlegm, and the Powder remaining is vastly acerb.

Spiritus Nitri Dulcis, (*Sweet Spirit of Nitre*), it is made by mixing Spirits of Nitre and of Wine together, and digesting them; it is used in bilious Colicks, where there is a great Heat and Thirst and Choler abounds; it is a great Diuretick, and very pleasant; it is observed, that if the two Liquors be long digested, that you have Crystals like Salt-petre, which is the Acid pure; Spirit of Nitre is call'd *bezoardick*, when it is distill'd from Bezoar Mineral; it is only used to dissolve Antimony.

Spiritus Formicarum, (*Spirit of Ants*), is stomachick and diuretick; it plainly appears to be acid, because it corrodes Iron into Rust, and dissolves Lead, and makes Saccharum Saturni of it, and because it turns blue Flowers red: how this Spirit came to be call'd *Aqua Magnanimitatis*, is hard to say.

Cayenne Antimonii, is aperient, cooling, and diaretick; and Ettmuller says, that with it artificial Spaws may be made; but what sort of Spaws are they? Let us consider how it is made, to find this Assertion out; it is made with Antimony and Sulphur distill'd into Water, or with Antimony, Salt-petre, and Sulphur, or with Antimony, Tarcar, Flint-stones, and Salt-petre distill'd; it then appears to be the Acid of these Ingredients distill'd off, and unmix'd; therefore it can only acidulate the Water, and does no more than any other Acid will do.

Cremor Tartari, (*Cream of Tartar*), it is a Laxative in an Ounce, otherwise it is a good Cooler in a small Quantity, and in ardent Fevers is proper to a Scruple or half a Dram at a time, and as its Taste is more agreeable than Salt-petre or Sal Prunellæ, it ought to be preferr'd to it. If you give it in Liquor, it must be dissolved in warm Water.

Unguentum Nutritum, is cooling, drying, and cicatrising; it is made of Litharge, Vinegar, and Oil of Roses, or of Saccharum Saturni and Oil; wherefore it is an *Oily-acid*, wherefore it lenifies and repels, and is used in hot Pains externally.

Emplastrum Diapalma, is a Cicatriser, and in any slight Scratch may be apply'd. The *London Dispensatory* of the last Edition have thought fit to leave out this Plaister, for what Reason I can't tell, for it is much in Use every where.





PRAELECTION III.

On WATER.



ATER is a limpid, clear, transparent, insipid, inodorous, moistning, yielding Fluid ; its Particles must be in their first Composition very *small* ; for they enter into Bodies with great Ease, and pierce thro' their Interstices, and *dilute* them ; so that Water is call'd the *universal Diluent* ; it is so minute as to enter Boards in moist Weather, so as to fwell them, and to penetrate thro' a Bladder, so as to dissolve Sugar-candy put into it, and if the Water be heated, it will turn Salt of Tartar put into the Bladder into an Oil in an Instant ; and altho' we cannot readily distinguish their Figure, that, however, must needs be *spherical*, and touch in very few Points, because they yield upon the smallest Impulse, and because they *cohere* so slightly, and give way upon every Force, tho' ever so small, and

and exhale with the least Heat, or Wind ; its Particles are so small, as to fly away upon any Pressure, and Ice itself loses Weight by being kept, and if you fill a Vessel with Water, expose it to freeze, and then warm it only so much as to melt, you will find the Water has lost Weight : hence its Parts must be very *volatile*, and stand ticklish upon each other ; it therefore follows, necessarily, that Water must have a great many void Spatiola or *Vacuities* in it, fill'd with Air, which must readily enter, and as quickly find a Passage out again : It is the *lightest* Fluid we know of, except volatile Spirits and Oils, in the number of which last I include Brandies, Wines, Oils of Turpentine, of Olive, and such like ; and it is somewhat surprising, that so soft as Water is reputed, it is even *harder* than Gold in its component Parts, so that it cannot be compres'd by the greatest Force into a smaller Compafs : Lastly, it *repels* oily Bodies, so that these two will not mix together, but by an intermediate Substance, and even then, in a certain Space of Time, they divide again, and the lighter Oils will swim at Top, but the heavier do first make the Liquor white, and then fall down to the Bottom ; this is the Case of Mineral Waters, which contain a *Naphtha* or *Bitumen* in them, the lighter Part of this oily Substance swims above, and gives various Colours like a Peacock's Tail, whereas the heavier upon standing gives the Water a white and muddy Colour, and then falls to the Bottom ; and the Antients call'd it *ἀπνία, μωξή, οὐ τριπόνος ἔχει*, i. e. without any Quality, insipid, nor has it any thing cutting in it.

Having given you the Description of Water, I must observe to you to which Kind of Fluids it must be referr'd ; we are made to observe four Sorts of Fluids, one is call'd a *bumeting Fluid*, and

and such is Water; another is call'd a *dry Fluid*, and such are Quicksilver or boiling Alabaster, or Sand, or any Powder; a third is call'd a *hot Fluid*, such are the Flames of Fire; and a fourth is call'd an *aethereal Fluid*, and such is the Air, or Æther: however, altho' Mercury be a dry Fluid with regard to our Hands, yet it is not such with respect to Gold, Silver, Tin, or Lead, to which it adheres closely and dissolves; and altho' Water be a moistning Fluid with respect to us, yet it is not so with regard to Ducks and Geese and Water-Fowl, whose Feathers it does not moisten; the Division notwithstanding holds.

Water is one of the *Principles* in Bodies, and there is no Body ever so dry, but it resides in it, as will appear by Distillation; there is no need of Fire to extort Water, it appears so evidently before us, springing from the Bowels of the Earth; and where it does not appear in Bodies, it may soon be discover'd by Distillation or Evaporation or the frigorifick Mixture; there is no occasion for an actual Fire, a Hot-Bed made of Horse-Dung and Oak-Bark, or of Horse-Dung and Lime-Fluid, *Stratum super Stratum*, will serve the Turn to evaporate the Water.

Physicians call Water a *passive Principle*, because Salts and Oils are found dissolved in it, as in a Vehicle; for it is rarely found homogeneal, as appears by its putrefying and smelling when kept any Time; and it is *partly active*, inasmuch as it dissolves Salts and viscous Bodies in it, which is done by Attraction: so that we may properly call it a *neutral Principle*.

It is seldom, I say, homogeneal; for if we distil Water ever so often, we always find a Crust of Earth on the Still; the Water of Cities is loaden with Smoak, and that of Houses with Salts; the purest Water is without Taste or Smell, and that which

which keeps the longest without smelling is the purest and most principal; the Water drawn out of Wells turns Violets infused in it green, and therefore this Water must be impregnated with fix'd or volatile Salts; the more milky Water is, like the Lake of *Geneva*, and the sweeter it is, the more heterogeneous Parts there are in it; the *Thames Water* smells under the Tropicks, and if a Candle be held to it, 'twill flame up, so that it contains much Oil. The purest Water contains some Sea Salt in it, which is known by its precipitating Silver out of Spirit of Nitre, by being precipitated with Salt of Tartar, by its growing hot with Oil of Vitriol, by its throwing Quick-silver dissolved in Spirit of Nitre down into a white Powder; for as it is Salt it precipitates whatever is dissolved in Spirit of Nitre or in Oil or Spirit of Vitriol; and Sugar of Lead turns white by Water: and what proves the *Heterogeneity* of Water to a Nicety, is, its Power of nourishing Plants of various *Species*, it dissolves various Parts, and carries them into the Tubes of them and enlarges them; it is a Vehicle consisting of various Parts: It is a ridiculous Sentiment then to suppose, if Water were homogeneal, that it could nourish, it would enlarge it, but then the Plant would want Taste and Smell.

Some affirm the purest Water to be Snow melted; *Hippocrates* calls it the worst of Waters: I know they prescribe it Abroad, and in heitical Cafes; but in regard of its Homogeneity, Rain-water or clean Snow bid the fairest, if they are filter'd.

If we would have Water pure, we must know what Particles it contains, and how to get rid of them; as to the first Method, I shall descend to the Discoveries of what Bodies Waters contain, at the latter End of this Lecture, and the best Way to

to get rid of them is by Exhalation of the Water, or by Putrefaction and Filtration thro' a pumice Mortar.

As for the Properties of Water, I shall *first* observe, That of all Liquors it is the least *cohesive*, which appears from its *Incohesive*. Cession upon the least Contact, and if you boil it or only warm it and put it into the Air-Pump, it boils up, but does not cohere like Ale or other fermented Liquors, the Air flies out in great Quantities, and with a Noise, but no Bubbles are afforded: Hence is it esteem'd very fluid and smooth, and spherical and fit to promote Motion, and to ascend upon any Warmth.

Secondly, Its component Parts are *small*, and even smaller than those of *small*. other Liquors, and, Mr. Boyle says, even smaller than the Particles of Air itself; and that it can enter where the Air does not, especially if a little Warmth be made use of, because Heat divides its Parts into its component Molecules; I have already said, it will enter thro' the Outside of a Bladder into the inner Side, and Bellini puts a Stone into the Skin of a *Cranium*, and plunges it into Water so as to subside, and finds that Water will penetrate into it; hence does he conclude, that Baths enter thro' the Skin, since doubtless the Pores are more open in living Bodies than in Carcasses; if therefore Water can enter the latter, it must pierce the former.

Thirdly, It is *fugitive* and *light* com-
paratively with Earths and Acids, but *Fugitive,*
not with Air, Oils, and volatile and *light*. oily Spirits; for the least Heat makes it mount into the Air, nay, even Winds carry up a great deal of it, from the Agitation it receives from them, and it even flies off spontaneously, because it is observed that old Bread is much lighter than new,

new, and therefore more wholesome ; but as great Age or very much exposing of Bread to the Air makes it very much lighter, I wonder our Sailors have found no Method to prevent this Inconvenience as yet ; what can be more fugitive than Camphire? and yet our Apothecaries prevent this Loss of it, by covering it with Linseeds : if therefore the Admiralty or Merchants would contrive to keep their *Biscuit* in Tin Vessels, with many small Divisions in them, and cover each of them with Linseed, it were possible for them to keep their Bread for Years together without Diminution of Weight.

It is fugitive, because it is fluid, and yields upon the least Impression ; it is circular, and therefore touches in fewer Points, and therefore flies off upon the least Force impress'd, whether by Fire or Air, but volatile Spirits, as to their Effluvia, Air, and Brandy Spirits are lighter than Water.

Fourthly, It is *incompressible and Incompressible*. hard, but not elastick, and will be rarefied with the least Heat; Principles, in the Senſe I take them, are incompressible; and by consulting the *Florentine* Experiments we shall find that a Force capable of compressing Air into a Space a thousand times less than its natural Bulk, could not compress Water the Breadth of one Hair, altho' it was try'd by Mercury pour'd in, by Ice, and by hammering Silver and golden Vessels in which it was included ; if it were elastick, it would yield and give way, and be driven into a less Compass, as we experience in Ivory Balls ; however, all the World knows how Heat will swell it and turn it into Bubbles.

Fifthly, It is a proper Menstruum *Dissolves Salts.* of Salts, and what is peculiar, it will dissolve a great many different Salts without

without any sensible Increase of its Bulk ; for Example, suppose you dissolve as much Alum as it will hold, or till it refuses to dissolve more, then put in any other Salt, till it will dissolve no more of that; put in a third and fourth, it will dissolve them in the same Manner ; yet all this while, its Bulk is not perceptibly augmented : nay, if you put Oil of Vitriol into Water, the Mixture grows hot, but takes up less Space when thus join'd than the Bodies do separately, they grow indeed heavier both absolutely and specifically : from this Property we plainly conceive, that Water has a great many Vacuities or empty Spaces, which contain Air, and which receive Salts of all kinds ; by this Property it is, that *Mercurius Vitæ* is render'd less fierce, and from a rugged and dangerous Vomit, becomes milder and purgative by washing ; wherefore it divides the Salts and hinders their Contacts, and if the Proportion of Water be great to that of Salts, they will be so dissociated as to give our Palate no Notice of their being contain'd ; and if Water by washing or infusing Bodies in it does not taste saline, these Bodies are void of Salts.

N.B. Oil of Vitriol will not boil with Steel, unless Water be added to it, which shews Water to dissolve the Salts and to make them act.

N.B. From the fourth and fifth Property of Water, we may fairly infer, that, as it is a proper Menstruum for Salts, and that they very little increase its Bulk, and also as it will rarefy upon a small Heat, it will dissolve a greater Quantity of Salts when it is warm than when cold, in such a Proportion as the Heat is greater, because Heat enlarges the Space of those Vacuities, which appear very large without any rarefying Cause ; hence

hence Physicians have an Opportunity of conveying more Particles into the Blood and Vessels, of any Remedy soluble in Water, by giving them in a warm than a cold Vehicle ; hence also does it happen, that great Quantities of Particles subside in Water when it grows cold, which were suspended in the Vehicle, whilst it remain'd warm or hot.

N.B. Whenever we would rid any Body of its Salts, Water is the proper Menstruum to effect it ; so that if a Body be oleo-saline, the Salts leave their Hold of the Oil and fall into the Water ; and thus it is we take the Smell from Oil ; for by washing the Oil in warm Water the Salts are carried into the Water, and the Oil swims fresh at Top.

From this Property it may be concluded, that where nothing is communicated to Water, there can be no Salt in that Body ; and hence as Violets communicate a Tincture to it, they must contain a good many saline Parts, which have attenuated the Oils so as to make them give out their Colour.

From hence also Salts swimming in the Air are dissolved by the Moisture and Warmth of it, and these Salts being thus dissolved promote Putrefactions, Rancidities, and Fermentation, and from this Condition of the Air we find Fevers to arise ; Moisture and Warmth dissolve the Salts and heterogeneous Parts in our Victuals, and cause them to smell soon, because it raises an intestine Motion ; for *Salts don't act, till they are dissolved.*

Sixtly, It dissolves watry Gums
And watry and viscous Bodies ; for sixteen Ounces
Gums. of Water will dissolve one Dram of
Gum Arabick : hence I refer you to *Attraction*
for the Particulars.

Seventhly,

Seventhly, It repels Oils and oily Bodies, unless by the Intermediation of a Lixivium or the Yolk of an Egg; wherefore it will not dissolve Resins nor resinous Gums, but by the Means now mention'd; for it precipitates sulphureous Bodies, as appears in the Tinctures of Benjamin or Sulphur, which grow white by pouring them into Water, or as may be seen in the making Resin of Jalap or any other Resin, where pouring the strong Tincture of Jalap made with Spirit of Wine into Water the Resin subsides to the Bottom: but if any Lixivium or the Yolk of an Egg be made use of, then do these Bodies readily unite; Wool is not made clean without some Lye, in which it is boil'd, Water alone will not cleanse it; Wool is very oily, and as Oil will not unite with Water, a Lixivium serves this Turn; Salt of Tartar dissolves Turpentine, as well as the Yolk of an Egg, and in some Cases it is better, particularly for Glysters, because it irritates the Bowels: Choler joins in with Water, because its *Analysis* shews it to be a Mixture of Oil, fix'd Salt, and Water.

Eighthly, It does not dissolve, tho' it suspends *Earths* or earthy Particles; Bodies may be reduced into so minute Parts as to lose much of their Gravity, so that the Particles of the Fluid may resist by its Tenacity more than the Earth gravitates, and this appears in petrifying Waters, whose Parts are so minute as not to diminish the Transparency of the Fluid; it must, however, be granted, that this Transparency vanishes as the Earth abounds: If Water did not unite Earths, we should meet with no Cupels or Potters-ware, the former being made of animal Ashes of Bones mix'd with Water into Paste, and dry'd by a gentle Fire; and the latter of a certain Clay,

moisten'd with Water, dry'd in the Sun or by a moderate Heat, and then baked ; but I would have it observed, that this Cementation could not happen, if some Oil or bituminous Substance did not intervene ; and as to Glass, I shall speak of it in its proper Place.

N. B. From the 5th and 8th Properties, it appears why it separates Salts from Earths ; for as it is a specifick Menstruum for Salts, those unite to the Water, and leave the Earth to fall down.

Ninthly, Water is *not elastick*, if it were, upon Compression it would be reduced into a less Space and Compas,

like Ivory Balls it would recede upon any Force, and return into its pristine Shape : but all the Experiments try'd by the Florentine Society could not compress it into a narrower Space, from whence it may be concluded, that its component Parts are harder than Metals of any Species ; for they upon hammering will weigh specifically heavier, which is a Demonstration that their Parts come nearer under Contact, and their Pores become less, which is an adequate Notion of Density ; Quicksilver will also become denser by calling off its watry Parts, and destroying the Acids that cling to it ; Glass is denser than the Earth that composes it, because the Parts join closer, and the Pores are diminish'd.

Tenthly, It contracts Solids immers'd into it, whilst it is cold ; but relaxes them, if it be hot ; Water is a wetting Fluid with regard to our Skin

and Fibres, that is, it adheres to them, and that Force which swells it into a larger Space, will draw every thing it adheres strongly to, into the same Condition ; if we therefore suppose Water

to

to be rarefied into a Space five times greater, what it adheres to will follow that Proportion: this would be true, if Rarefaction and Adhesion were the sole operating Causes, but beyond these we must take our Juices into the Account, which upon Heat are expanded, and so blow up the Fibres into larger Dimensions: The contrary Reason holds for the Contraction of our Fibres or any Solids, whilst it is cold; for this sticking to them purses them up, and also condenses our Fluids, and the Fibres having a natural Spring, they recoil and embrace the Fluids more closely: Iron when hot swells far above its natural Dimensions, but immers'd into cold Water it is easily reduced into its genuine Bulk: All Vessels whatever, or of what Stuff soever they are made, are dilated by Heat, and hold more at that Time than when cold. The Action of Fire upon Solids and Fluids is first to dilate them, and as Water yields most readily to the Heat, so it is capable of that Effect sooner than other Bodies, and produces this Effect upon whatever it adheres to most readily; when apply'd externally its first Effect is produced upon the containing Parts, but if it continues upon the external Parts, in Process of Time it also affects the Fluids: This Experiments have proved, that the first Alteration made by Heat or Cold is perceived on the Solids, and the Fluids do presently follow their Condition; in Cases from the Coldness of the external Air, the Solids or containing Parts are first affected; in cold Bathing we do all the great Feats that are done by the Contact of the cold Water upon the Fibres, they are primarily changed from their relax'd State into a contracted one, and the Liquors or Juices contain'd are secondarly only affected; this appears from the Experiments made by the Society of Florence on Solids, p. m.

104. *Acad. del Cemento.* But where Water is scalding hot, then it does not relax, but corrugates them, and either quite destroys their Texture, and turns them into Ulcers, or however does so crispate them, as to hinder their Action, and disturb the Circulation.

Eleventhly, It *dilutes* Fluids ; by *Dilutes.* Dilution is comprehended an Interposition, an Entrance of Particles between the Spaces and Voids of Liquids ; to dilute, a Body must be incohesive, it must be globular, and voluble, for it must divide the Parts of a Fluid : By such Interposition, the Salts and offending Particles are set at greater Distances from each other, their Attractions and Clusterings are prevented and obviated, as they are put into Action by a convenient Quantity of such a Fluid ; so that according to the various Management of it, there is either a proper Struggle raised or allayed, from which arise Digestion, Secretion, and Circulation, or they are check'd by the Use of such a Fluid ; because if there be a certain Quantity of a Fluid required to dilute, more than is requisite would prevent the Action of the Salts, by putting them at too great Distances, and beyond their Sphere of Attraction ; and less than should be, would suffer them to approach too near to each other, so that they would run together and unite, and either ulcerate and corrode the Flesh and Solids, or produce Pains and other Un-easinesses.

Twelfthly, These Properties mostly serve the Physicians Turn for explaining the Virtues and Effects of Water on human Bodies ; however, Water has also other Properties fit for the Service of Mankind ; for all know, that Water *will freeze* by Cold, and that no other Body whatever freezes unless because it contains Water in it ; thus rectified

fied Spirit of Wine does not freeze, but common Brandy in an excessive Frost will freeze, because it contains more than half Water, for from sixteen Ounces of Brandy we obtain five Ounces only of a spirituous Substance, the Remainder is Water, and we are told, that Brandy is got from frozen Wine in *Nova Zembla* by the Sailors; Spirit of Hartshorn with a hard Frost freezes, but Spirit of Salt Armoniack made with Lime will not freeze; and whether this Cold be natural or artificial, the same Effects are produced; hence the *Frigorifick Mixture*, which is made of Snow or Ice and common Salt or Salt-petre or Salt Armoniack or Vitriol or Alum or Mercury Sublimate, will freeze Water and watry Liquors.

It is true, that if the Vessels containing the watry Parts be of Gold or Silver or of any other Metal that is thick, and they be close, neither Nature nor Art can freeze the Liquors contain'd, but that is owing to the Imperviousness of the Vessel containing, not to the Liquor contain'd.

Hence neither Mercury nor strong Acids, nor volatile Spirits highly concentrer'd, nor any æthereal Substances will be frozen.

Ice is made of Snow by a great Degree of Cold, so that Oil or Spirit of Vitriol added to it will turn the Snow into Ice: and as Ice transmits the Rays of Light, so will it also pass the Rays of the Sun, and Ice polish'd into a concave or convex Figure will burn like a Burning-glass.

From hence may we conclude, that Ice is the natural State of Water, since if the Sun-Beams or Heat did not keep it fluid, it would ever be under that Shape.

What Causes may contribute to Freezing, and the *Modus* of it, are hard to account for; nor do I think those who have hitherto consider'd this Matter have been throughly skill'd in the

Affair they undertook. How Snow and Salt mix'd, freezes Water, is not to be known by such as don't know that there is always raised a Struggle between Nitre and Salt ; that if the two Spirits of Nitre and Salt be mix'd, a furious Struggle arises, and Steams exhale, and even if Nitre and Salt are mix'd together, a subtle Steam arises.

Thirteenthly, Water acts by its *Weight*; it is to Air as 800 or 900 to one; and as Bodies are buoy'd up or lose of their Weight in Proportion to the Density of the Liquors or Fluids they are immers'd in, so any Bulk sunk into Water must lose considerably of the Weight it had in the Air, as any Bulk will preponderate in *Vacuo*, the same Body weigh'd in the open Air of a Cave; and Water is denser as its Contents or as its heterogeneous Parts are, that lie conceal'd in the Fluid: The colder Water is, so it don't freeze, the denser it is, and the hotter, the more rarefied it is, so as at last it approaches to Air, by flying off in Vapours: These Vapours exhal'd from the Surface of the Earth occasion the Varieties of Heat, Moisture, and Cold with us, and bring on various pestilential Seasons, as they are loaden with venomous and noxious Particles, whose Vehicle they are; were it not for these aqueous Vapours floating in the Air, the nitrous Spirit of it would be too keen and corrosive, which Experience shews, and yet if it be too much diluted by Rains, this vital Spirit is extinguish'd; by too much Heat it is lifted on high, and we breathe with Difficulty; so that too little Water or too much in the Air are equally prejudicial to the Health of Mankind: Hence the Comparison made between the Air's and Water's Weight is only relative, or is only consider'd as Things stand at present.

As to its Heat, by boiling it is rarefied to one twenty-sixth Part more than it is when in a natural State ; and Oil of Aniseeds and Butter discover its Degree of Warmth, which, to discover to a greater Accuracy, we make use of a Thermometer, and the Coldness of this is determined after the contrary manner ; for as Warmth melts the Oil or Butter, and causes the Liquor in the Thermometer to ascend, so on the contrary, Cold congeals the Oil or Butter, and causes the Liquor in the Thermometer to subside ; for all Liquors whatever are contracted into a narrower Space by Cold.

Water is subject to a *Mustiness*, which is a plain Proof that no Water is homogeneal by Nature, and this Accident depends on some Sulphureo-saline Parts, as appears by its being destroyed by Frost ; for Water in an earthen Jug, if it becomes musty, if it chances to freeze and be thaw'd again, this Smell is destroyed ; and it also vanishes by the Smoak of Sulphur, by the Help of Fire, or by Quicklime, which plainly shews that this Phœnomenon depends on an Acid and Oil fermenting together, as may be gathered from what has been said in the Lectures on *Oil* and *Acid*.

Distill'd Waters are liable to gather into a mucilaginous Substance, call'd *Mother*, it is a mucous Matter, which contains wrapt up in it, as in a Cage, a young Plant or more, says Dr. *Power*, as he has found by the Microscope.

Take Horse Dung, put it into a Hole of the Earth for a Foot thick, then put Quicklime to half a Foot thick, upon this put more Horse-Dung to a Foot thick, then place a Vessel surrounded with Horse Dung and Quicklime mixed ; press all hard down ; every second Day water this Matter gently, till it will no longer be hot with Water, for then new Materials must be used of ;

and this Heat will evaporate Water, and may be useful at Sea for procuring fresh Water.

In order to prove that Water, as in the Bowels of the Earth, is not an homogeneal Substance, I shall produce a great many Instances which may be of use to the Publick ; by producing various Examples of this Kind, you will be inform'd of the Nature of Waters where-ever you dwell, and be able to pronounce *a priori* on their Contents and Virtues.

And that I may begin at Home, I shall first regard our Bath Waters, Tunbridge, Scarborough, Epsom, Yorkshire Spaw, Bristol, and the Dripping-Wells.

Bath Waters are far from being pure and homogeneous Water, for they contain in them, besides their Vehicle, Salt-petre, Vitriol, common Salt, and Sulphur ; 1st, As they are Water, if we drop into them Tincture of Benjamin, they grow milky, for oily Substances will not unite with Water alone.

2dly, As they contain Salt-petre, they grow of a brownish Colour by throwing a little of green Vitriol into them ; and if you boil Flesh in them, the Flesh becomes red.

3dly, They contain the Vitriol of Steel in them, because with the Powders of Galls or Tea, or Oak Leaves, or Balaustine Flowers, there follows a Precipitation, and the Liquor turns of a Claret Colour ; and *Saccharum Saturni* makes them milky ; for as I observed in the Lecture on *Acids*, whatever Oil or Spirit of Vitriol dissolves, may be precipitated with Vinegar : Vitriol is made of the former both by Art and Nature, and Sugar of Lead is made with Vinegar.

4thly, They contain common Salt, because with Oil of Tartar there is a gentle Coagulation and Precipitation, and with a Dissolution of Silver in

in Spirit of Nitre dropt into them, a Precipitation ensues.

5. They contain Sulphur in them, because Silver lying in the *Bath* Water for some time, is dy'd yellowish Black: How this Sulphur is dissolved in the Waters, I will not determine, but must believe somewhat, as yet undiscovered, contributes towards this Effect: Lime calcin'd, or Salt of Tartar melted with Brimstone, will make it capable of being dissolved in Water, and this Sulphur is precipitable into a milky Substance by any acid Spirit; nay, antimonial Sulphurs answer in the same manner: So far is evident, that the Clay of our *Bath* Waters will gild Silver, and if it be boil'd in Oil, it will make a Balsam of Sulphur; but the intermediate Substance that unites this Sulphur to the Water, has not been discovered as yet, as far as I know, which shews the Indolence of those who reside upon the Place, who have delivered their Virtues down to us from Experience alone, without much Inquiry into the $\Delta\delta\sigma\pi$, or Cause why they operate, which requires a perfect Acquaintance with the *Materia Medica*, and the *Analysis* of the Bodies, and depends on a Chain of Reasoning deduced from thence, and these are Talents all don't possess or endeavour at.

However, lame Experience informs us, that these Waters being hot, as well in Fact as in their Nature, do cure, and consequently prevent cold Diseases: The Particulars of which I shall have Occasion to discant upon in the Sequel of these Papers.

The famous Waters of *Bourbon*, and of *Aix la Chapelle*, are referred to this Head.

Tunbridge Waters, by Galls, Tea, Oak Leaves, and such Drugs, turn Purple, and shew us they contain Iron in the Form of Vitriol; for as Vitriol is

is Iron turn'd into a peculiar Form by an Inter-mixture of Acid and Iron corroded, these Ingredients by their fix'd Salts unite with, and attract the Acid in the Composition, and leave the Iron to subside in the Shape of Ochre ; there are some few Particularities by which our *English* and Foreign chalybeate Waters differ, for Example, The *German* Spa precipitates a Solution of sub-limate Mercury into a white Colour, which shews that the Marle it issues from, has a volatile Salt in it, and it has a vinous Taste, which our Waters want ; and the *Pyrmont* tastes very sharp : There is made a factitious Spa-Water resembling *Tunbridge* Waters, by making a Tincture of Steel with distill'd Vinegar, in the following manner ; We take twenty Ounces of Rain or Fountain Water, Spirit of Spa-Water (or the remaining Part of the Liquor of Salt of Steel, that will not crystallise) ten or twelve Drops ; then fire a Match of Sulphur so as the Water may receive the Steam, keep this for Use ; or we may make it according to Mr. *Boyle*, with Steel and distill'd Vinegar, or as some do, with one Pound of Water, three Grains of Salt of Steel, and one Drop of Oil of Vitriol, the more of which last is in the Liquor, the sharper it will taste. *Platerus* indeed, commends Vinegar before Oil of Vitriol, and says of the latter, that he has observed ill Effects from these Spa's made with the said Oil : These chalybeate Waters, upon Distillation afford much Water, a very little Acid, and the Metal remains at the Bottom of the Still.

Whether these Drugs be made into Powder or Tincture with Water, or even with Spirit of Wine rectified, the same Colour is struck by them ; for where-ever the Salt can be dissolved or attracted by Liquor, it will precipitate the Steel in the same manner ; however, in rectified Spirit of

of Wine the least of the Salt is contain'd, and the Tincture will be less than with Powder, or with a Tincture made with Water.

Filings of Steel one Part, distill'd Vinegar ten Parts, eight Ounces of Water digest: Give four or eight Drops in Water. Or mix as much Salt of Steel with Rain Water, as will give a vitriolick Taste to it; fill Jars with this Liquor, fire Sulphur Matches with which Coriander-feed was mix'd, let the Steam enter the Jars so as to impregnate the Water and make it tart, then seal up the Liquor, and it is a factitious Spa-water, fit for Use.

Bristol Waters, as Water in general, they make Tincture of Benjamin white if dropt into them; and as most other Waters they contain Sea Salt, because they precipitate Silver out of Spirit of Nitre into a grey Powder, and they effervesce with Oil of Vitriol; and they precipitate the Salt of Lead, because there is some Vitriol in them; but as they precipitate with Galls into a brownish white Sediment, and as they turn Flesh boil'd in them into a blackish Red, it appears that their Vitriol is from Copper; with Syrup of Violets they turn Green, therefore they have some alcalious Parts in them, but with sublimate Water they afforded no Alteration nor Precipitation, therefore this alcalious Salt is neither Lime, fix'd Salt, nor a volatile one, or the Syrup is nicer for the Discovery of Salts than the sublimate Water; there must be Alum, because Metal and Chalk diluted with an Acid Ros make an Alum: Dr. Winter says, he found a fix'd Salt in them; for my Part, I think the Faculty is too indolent in making Experiments on this useful Subject.

Purging Waters contain a *Nitrum Calcareum*, because they curdle with volatile Spirits into a White, or with Lime-Water, and also with a filter'd

filter'd Solution of Sugar of Lead ; and with sublimate Water they are precipitated into the Colour of a ripe Orange Peel ; hence do they contain an acid Salt, and a *Natron* or Nitre of the Antients. That they contain some Acid is plain from their curdling Milk ; and that this Acid is an aluminous Body would appear by their turning white with Galls ; so that these Waters are a vitriolic, nitrous and saline Mixture, and resemble a *Sal Mirabile*, where the vitriolic Oil is join'd to the alcalious Part of the Sea Salt, and is very irritating and purging ; and the Basis of these Waters seems to be Chalk, Loam, and Iron, on which a Ros or acid Steam fixes and turns into a Vitriol, Nitre and Sea Salt, which join'd together do purge ; for if we take a View of the said *Sal Mirabile*, it is composed of the *Caput Mortuum* of Salt join'd in with Oil of Vitriol.

Sal Mirabile Glauberi. Take the *Caput Mortuum* left upon distilling *Glauber's Spirit of Salt* ; dissolve it in warm Water, filter this Dissolution through Cap-paper ; evaporate one third Part of this Liquor, put the Remainder in a Cellar for some time, till it crystallises, take off the Crystals at Top. Caution must be had that you don't evaporate too much of the Water, because this would make them too corrosive.

The Petrefying Waters are only Sand join'd to some mucous Matter, and upon Evaporation the Sand appears at Bottom : The acid Matter makes the Sand invisible by reducing it to Atoms. We make a petrifying Mixture of Flints in the following Manner ; We take Flints and calcine them with Pot-Ashes, and set them so calcin'd in a Cellar, and let them run, then we mix this Liquor with any strong acid Spirit, and they turn into a Stone.

Scarborough Waters are partly Nitro-Calcareous, partly Chalybeate, so that they purge and attenuate.

Knaresborough Waters are of two Sorts, namely, the Sweet or Chalybeate, and the *Stinking Spaw*, which is Sea Salt and Sulphur.

If we consult *Fallopis* and *Bacchus*, we are little assisted in the modern Method of examining the Contents of Waters: The *Academy of Sciences*, Drs. *Lister*, *Allen*, and M. *Moullin de Marguery*, give us the best Hints for discovering their Principles; and they who would be skilful in this Art, must have an accurate Idea of the Force, Power, or Energy of different Bodies under Contact; they must be therefore well skill'd in Chymistry, and more especially in the Laws general and particular of Precipitation, which the more we are enlighten'd in by repeated Experiments, the better and more sure shall we be in pronouncing nicely on the distinctive Marks of the Bodies subsiding.

In the mean while, give me Leave to enter upon a small Detail, which others Experience, and my own, have discovered, to mark out what Contents are in Waters.

Vitriol of Copper, or *blue Vitriol*, is discovered to reside in Liquors in the following Manner, by an Infusion of Galls pour'd into them, or by their Powder, the Liquor turns milky, and a greyish Powder or Substance settles at the Bottom; Spirit of Salt dropt on such Liquor, gives them a golden Colour; but Galls give the Liquor a bluish green Cast: If you drop Aquafortis on Copper, the Tincture is a bluish Green; Copper turns green with all Acids, as has been said on *Acids*, but with Spirit of Salt it is of a golden Colour.

Green Vitriol, or *Copperas*, turns of a purple Colour with Galls; green with Spirit of Salt; and

and Steel with distill'd Vinegar gives a yellow Tincture.

White Vitriol by Galls causes a palish blue Sediment to fall to the Bottom.

N.B. All Vitriols whatever turn the Tincture of Turnsole, which is blue, into a red, as do all Acids.

If you take Salt of Tartar and Sulphur in equal Parts, melt them till they grow red, and become a *Hepar Sulphuris*, then add half their Weight of Salt Armoniac dissolv'd in Water; distil, and drop the strongest of this into vitriolic Waters, and they turn black; for this Mixture is a *Sal Volatile Oleosum*.

Nitre condenses into pyramidal Figures, or into hexagonal Prisms; it precipitates into an *Orange* Colour sublimate in Water; it fulminates when evaporated and dried with Sulphur; it makes Syrup of Violets *purple*; it swells upon a Fire in a Crucible; it precipitates Vitriol; it makes the Tincture of Turnsole purple; it is precipitated white with Galls.

Sal-marine does not disturb Sublimate in Water, it does not alter or change the Colour of Turnsole; it precipitates Sugar of Lead white from Water; it does not fulminate with Sulphur; it crackles upon an open Fire; it precipitates Silver out of Spirit of Nitre: Hence, when this Solution is dropt into Water, the more Salt the Water contains, the greater is the Precipitation of the Silver out of the nitrous Spirit. If the Salt be crystallised, as it is in *France*, it does not touch alcalious Salts in Water; whereas if the Salt be made by Evaporation and Fire, as it is in *England*, it coagulates with Oil of Tartar, or Salt of Tartar and

and Precipitation ensues, as it also precipitates Nitre out of Water.

Alum is precipitated white with Galls, it coagulates Milk, it turns Turnsole or blue Paper red; the Water curdles with Oil of Tartar.

N. B. Hence may it be inferr'd, that as blue Vitriol turns white with Galls as well as Alum, they cannot be esteemed a characteristick Sign of either, and we must have recourse to some other Criterion; and the same may be said of the Turnsole's turning red with each.

Sal Gem precipitates sublimate Mercury out of Water into a White; from hence may the prevailing Particles in it be volatile Salts; although we are sure by Distillation that Sal Gem gives out an acid Spirit, yet I shall not affirm that the other Part may not be a volatile Salt, although it has never been reputed such.

Lime in Water with Galls turns a clear red or a greyish brown; with Oil of Tartar white.

Natron is Saline, and tinges Paper bluish; it effervesces with Spirit of Nitre, and Vitriol makes it taste salt.

Salt Armoniac, with Salt or Tartar or Lime, becomes urinous.

Salt of Marle, which is often dissolv'd in Water, precipitates sublimate Mercury *out of Water* into a White, and is therefore a volatile Salt.

If *Lead* resides in Water, pour on Vinegar, and you see a white Precipitate drop; for Vinegar turns Lead into Ceruss.

If *Copper* be distill'd in Waters, put to them any volatile Spirit, whether of Urine or other, the Water turns Sapphirine.

If *Arsenick* be in Water (or Wine) if you pour on Oil of Tartar, or Spirit of Urine, they precipitate it

it into a black Powder ; and if to them you put Dantzick or green Vitriol, the Precipitate will be dark ; they precipitate a Solution of sublimate Mercury white ; and by Lime Water and Sugar of Lead mix'd, they give a black Precipitate.

Silver in Water, by putting a little Copper in the Silver falls down.

Gold in Water, by throwing Quicksilver in it, turns the Quicksilver yellow.

Quicksilver in Water, throw in Gold, they amalgamate whitish Yellow, and throw in Sulphur a Blackness ensues.

It would be an infinite Labour to descend to more Particulars on this Subject ; but they who attentively read over these Papers, will find Hints enough to let them into the Secret of the Detection of Bodies residing in others ; this will be of singular Service to them and the Publick.

From what I have said, it plainly appears, that Water is rarely or never Principal, but when we take Pains with it ; the Soil from whence it springs, contains Salts, Sulphurs, and Earths of different Kinds and Exaltations ; the Mixtures are infinite and often poisonous : The Feet of the Miners do often exulcerate with the fierce dissolving the metallick Parts, and floating in the Waters ; so that it behoves a Physician to determine on the Salubrity of the Waters where he resides, that those under his Care may avoid Danger, and advance in Health. I can't see how a Gentleman of the Profession can prove so indolent, as to neglect this Task, which Honour and Conscience have drawn upon him, and with what Effrontery can he pronounce on a Subject he has taken no Pains about ?

The only Method that has yet appeared for making Water homogeneal, is the Fire ; for they who have made use of Precipitants to throw down any

any foreign Matter, have indeed effected what they designed, but then they have only changed Hands, by leaving the Water fraught with the Precipitant itself, which requires a third Body to rid the Water of the second ; and thus it is, *in infinitum*, incumbent on us to get rid of that by another, which last dwells in the Water, and makes it fully as Heterogeneal as at first.

However, when I speak of Water, I mean a pure and unmix'd Liquor, and its Properties are to be understood of this Fluid without any other Particles conjoin'd.

First then, as Water is the most *incobesive Fluid* we know of, it is fitted to destroy the Attraction of Particles towards, and their Cohesion with each other, wherefore is it advisable in all Cases where there is a Viscidity in the Juices of any Kind : It is very observable, that if Serum of the Blood or Urine be held over a Candle or Fire for any time, they will turn thick, and particularly the Serum does congeal presently, and so does the Urine also ; it is the watry Part that keeps them fluid, and that once exhal'd, the light Parts are left intangled in the gross ones ; if we mingle a good deal of Water along with the Serum or Urine, these Liquors will not grow thick by Fire, nay, they will not be operated upon by Acids, nor grow thick thereby : Hence does appear, the Power and Efficacy of Water to take off, and therefore to prevent Cohesions and Coagulations. Wherefore, as well in Phlegmaticick as Rheumatick Cases Water is required, so far as there is a Viscidity in the Juices ; but I would not be mistaken, and therefore I speak barely in relation to the Thickness or Viscidity of the Humours, which is, or may be destroyed by this Fluid : No one therefore must suppose me so void of Reason, as to advise the *Hydroposia* only in the low viscid State, where the overcoming the

Viscidity is not the sole *Indicatum*, because other Remedies are required at the same time for the Sake of the Salts that reign in the Blood, however, as Water is more fluid than the Particles of the Blood, it interposes its spherical and small Parts between the viscid ones, divides them, separates them from their mutual Contacts ; the Force that impels it is the Heart, by which the small Particles are intruded between the cohesive ones, they are divided, and are no more attracted.

Hence in inflammatory Cases, where the Blood is viscid, so far as it viscid, Water and watry Liquors claim a Preference before all others ; for want of watry Parts the viscous Juices stick in the smallest Arteries, and are thereby stopt, and hinder those that follow from going on in their regular Course : Hence the Vessels are distended, the membranous Tubes being very sensible of this Stop, we feel Pain ; and as Water serves as a Vehicle for these gross Parts, it thins the Blood to a proper Degree of Circulation. Pleurisies, Inflammations of the Lungs, feverish Headachs, and many such Diseases are remedied by Water-drinking ; hence also is it advisable in Rheumatick Pains.

Also in anasarcous Diseases Water is conducive to carry the other Remedies into the Vessels, it helps to separate these crude Viscidities into smaller Molecules, and once they are separated they cannot readily unite again ; but as I have already hinted, Water must only serve here as a Means to divide the viscous Parts, because we have no Design to depend upon it as the sole Cure of this State of Blood ; for after their Division, another Intention becomes requisite, the mention of which is not the Busines of this Paragraph.

Secondly, As Water is in its component Parts *very small*, it therefore is a fit Vehicle for opening Remedies ;

Remedies; no Tube in Animals is so minute, but Water will readily pass thro' it, and therefore, where Remedies have been unsuccessfully made use of to pass through our Vessels, Water is the most convenient Vehicle for conveying Medicines into the deepest Recesses of our Body; the Glands, and those the most contorted, are the most difficult to be penetrated, and therefore their Diseases require Remedies the most penetrating for their Cure: Hence in scrophulous Cases Water is the best Vehicle for conveying the proper Remedies into their most distant Tubes and Ducts, and for this Reason chiefly, alterative and purging Waters succeed best in such stubborn Cases.

Thirdly, As Water is *fugitive and light*, it makes our Juices more volatile and less dense, whereas Wine, by accelerating the Motion of the Blood, evaporates the more fluid Parts, and leaves the more fix'd and rigid Parts behind, and does in this manner make a dense Fluid, Water on the contrary makes our Fluids lighter, by keeping those Salts that are Volatile within our Vessels; for where *Stimuli* are blunted, they don't irritate the Vessels, nor therefore do the Fluids fly off, the Motion of them in the Circle being retarded.

Fourthly, Water is *Incompressible, and not Elastick*, we are sure therefore of the Quantity the Vessels contain, and that what we give loses no Bulk, although it may gain some; the Pressure therefore is equable on all Sides, and it will overcome the Resistances it has to conquer with more Ease; for if its Particles are so hard, as not to give way to, nay, even to force itself through Metals themselves, it evidently appears, how it will break through Cohesions of any Degree with any given Force; so that as upon the alternate *Systole* of the Heart and Vessels its component Parts are pump'd and press'd forward, either the Vessels must give

way, or the Cohesions must yield to the Interposition or Intrusion of its small Parts ; but as the Cohesion of the Vessels is generally greater than the Cohesion of the Fluids, these must yield before those ; and as Water contain'd in a Vessel of Gold, which is filled with it, will sweat through the Pores of the Gold, when the Vessel is beaten into a less Compass and Capacity, rather than yield or be compressed : Can we imagine the Cohesions of the Fluids to be stronger than those of Metal ? and that if it breaks through the latter, it will not also conquer the former ? Experience shews us this Truth, where Obstructions are wash'd away, and Cohesions are dug down by the Ingestion of watry Vehicles. There is one Caution I shall beg leave to borrow from the Practice, and it is this, to wit, as the Design of giving Water and watry Liquors in Cohesions, is levell'd against the harden'd Fluids, and not against the flexible Sides of the Vessels ; and as it is impossible for the Vessels near, or at the Point of Obstruction, not to be highly stretch'd by the Quantity arriving but not passing freely, by reason of the strong Current, it appears how much these Vessels are endanger'd, and how at last they may be broken : Now to avoid this Inconvenience, it is advisable, upon the Use of Water to make use of gentle Ligatures, where we can come at the Part above the obstructed Member, for they will strengthen these Vessels, and hinder a Rupture of them : this much resembles the Hooping of a Cask, to make it resist the Liquor's force, and to hinder its breaking.

Fifthly, It is a proper *Menstruum for Salts*. I have already hinted why it takes into its empty Spaces so many Salts ; why it divides their Contacts, or fits them for intestine Motion ; why a great Quantity spoils Fermentation, as well as Occur-

Occurrences in our Juices, and Commotions there; and how it is a *Condition, without which, Salts don't effervesce*: If then there is in our Juices a *just Proportion of Water*, the Salts are thereby dissolved, and Dissolution puts them into a Condition of struggling; for *Salts don't act unless they be dissolved*: thus will they meet each other at every Turn, and a proper Conflict is ever kept up between the contrary Salts: This Conflict maintains that Heat which ought to be in the Blood. If it be *Defective*, the Solids become rigid, and the Blood itself becomes an *Extract*, that is, it is so thick as not to be in a Condition to circulate, the Salts and Oils unite into Clusters; it is for want of this Fluid, that, upon Evaporation by a gentle and continued Fire, Flesh grows so rigid, that it may be made to keep for Ages without Corruption; and in Truth, the most secure Method of embalming Bodies is to put them into a proper Vessel over a gentle and lasting Fire, after Exenteration.

Lastly, If it *abounds*, it stops Fermentation, Effervesces, Struggles and Commotions, for *Phosphorus* itself is kept from flaming, or even being hot, whilst it is plac'd in Water.

There is then a certain Proportion of Water required to keep up the Circulation, which we shall further inform you of when we treat of the Practice of Physick: And *Water* is a Remedy against the excessive Quantity of Salts in our Blood and Vessels, which struggle, corrode and make too ravaging Efforts upon our Membranes and Solids; it is therefore very useful in *excessive Heats* of any Kind, for as they are Effects of the contrary Parts under a Conflict, we cannot better provide against this Consequence, than by setting these active Particles at a greater Distance from

each other, when they glide along securely and calmly, and the Heart and Vessels are less galled than before ; the Taste informs us fully on this Point, for the Tongue and Palate are highly affected with Bodies and Liquors too saline, and too richly laden with spirituous Particles ; but on the contrary, if these Liquors are made less picquant, they pass unobserved : So fares it with the Vessels, and upon the Use of watry Liquors the Heart is less stimulated, and the Circulation becomes more retarded, and the Heat less intense. It is exceeding good against *Fevers* of any Sort, but more especially against ardent and biliary Fevers *, for whatever Intentions Fevers casually demand, this is a stable, permanent, and constant Remedy against every Individual, because whatever Salts prevail in our Vessels, they are always to be kept at a proper Distance from each other, lest they cluster or ravage the Parts ; for it equally allays Rarefactions, and prevents Ruptures of the Vessels, as it prevents, and even cures Cohesions : Hence they in high Fevers must drink plentifully, and those who are seized with slow Fevers, must also make use of it in a discreet manner. The *Scurvy* of warm Countries, where volatile Salts abound, requires the *Hydroposia* to correct and carry off the Salts ; without it dismal Effects are produced ; For who is the Practitioner that has not seen what Symptoms the Scurvy produces ? The Chyle, the Blood, the Lympha, and the nervous Juice are all tainted with these exotick Salts, and it is so universal a Distemper, that no Part is free from its Rage, and we are obliged to continue the Use of Remedies for a great Length of Time to root it out of the Blood.

* *Αρινεῖας, μάλιστα τῷ πνεύ.*

Head-aches proceeding from Salts of the Blood that prick the Membranes, or rarefy the Humours, we put these Salts at Distances from each other, so that these Effects are not produced: It is the Business of a Physician to distinguish the Causes; when he perceives that Salts of any Kind, even Venereal ones, produce this Symptom, he must not neglect to prescribe watry Medicines, what other Remedies soever he orders, because, as Salts are in Fault, they must be put at proper Distances from each other before their Effects can be prevented. In *Drunkenness*, Hippocrates orders the Patients to † drink Water hot, because, as I have observed above, when Water is warm it is fitter for taking into it more Salts, since its Pores are more open to receive them; hence comes the Proverb, *that warm Water cools us*, as in Fact it does, where hot and fierce Salts reign in the Blood, and are to be taken up and carried outwards by the Pores or Urine: Now Water mixes readily with Brandy Spirits, which are a saline Oil, as shall be made to appear more evidently in the Lecture of volatile Oils.

It is useful against Bleedings, because Salts rarefy the Blood, and stimulate the Vessels, by which two Properties Bleeding is produced, and the Water quelling the Blood's Expansion, and dividing the Salts, stops them; indeed, in Bleedings the Water is better drunk cold, because, as by the Expansion mainly the Vessels are broken, any Warmth favours it, for Stimulation alone rarely breaks a Vessel, unless the Salt prove caustick. *Thirst* is best allay'd by washing with somewhat insipid, that is, with Water; every Liquor besides is fraught with Salts, and requires a more

† θερμὸν πόσιαν.

frequent Repetition than Water does: In this Case the Jaws are dry'd with a saltish Crust, and whatever we take besides Water, does in the End give this Scurf, but particularly sweet Things. *Scabs*, *Elephantiasis*, and other saltish Eruptions are highly assisted by Water, and it is not possible to cure Leprosies without Water; and if Cucumbers * will cure them, the sole Reason of that Effect is, because their Nourishment is watry: I have hinted above how Water divides the Salts, and carries them out of the Blood, some will ever be too large for the Diameters of the Vessels, or there are certain Concretions that never will pass through, or however, they always reside in the Blood, or leave enough behind to produce more; for take it which way soever, they are never carried off, and are invincible.

Hot Flatus are the Off-spring of heterogeneous Parts under a Struggle, for contrary Parts under Contact, though in the Course of Circulation dash against each other with Fury, and raise Bubbles, which are *Flatus* when they break; and as Flatulencies are always of the Nature of the Humours from whence they are produced, so these hot Flatulencies are the Creatures of strongly concentrated Salts and Oils under Conflict. Water is also good in *Pleurisies*, to dissolve the Grumes and Cohesions of the Blood, which are liable to stop in the small Vessels, to accumulate there, to distend them, and to occasion those terrible Pains, which such as have Pleurisies do experience, not only those Grumes floating in the Vessels, but also those which are deposited and fix'd, whilst not yet extravas'd, are in Fault; but then we must drink it warm, because cold Water has the

* *Heurnius Aph.*

Power of causing Grumes, not from itself, but barely from Coldness, as I shall observe anon.

However, as Water is very useful on many Emergencies, yet it is hurtful in the following Cases, where the Concoction is prejudiced.

Hypochondriac Diseases are caused by Salts of a keen and hot Nature, resembling concentrated acid Spirits, and their Stock is very often inexhaustible; such Persons are never easy with strong Liquors, their drooping Spirits indeed seem to be refresh'd for the present by such Draughts of strong and spirituous Things, but they dearly earn this momentary Relief, for their racking Pains, their disturb'd Fancies, their Restlessness, and all their usual Train of frightful and painful Symptoms redouble; Water alone, well chosen, and free from heterogeneous Parts, or fraught with Steel and Sulphur, is the only safe and wholesome Liquor for them, for this puts the Salts at a greater Distance from each other, it enters into the Body of the concreted Blood, and dissolves them, which however are the hardest to dissolve of all the States of the Blood, there being so much Earth join'd to the oily Parts of the Blood along with the Acid contain'd, that these Concretions are mere Plaster and Cement, and too often these Grumes are invincible, or sometimes the Acid that prevails in the Blood is so keen, that it corrodes all the fibrous Part of our Juices, and renders them too thin and fluid, and then excessive and racking Pains excruciate and torment the Patients; however, in this Case also Water is absolutely necessary, and has better Success than in the former State, because it finds no Resistance, and passes on with the greater Ease to the remotest Recesses and Meanders of the Vessels, dilutes every Section with certainty, and gives more certain Relief upon

upon a proper Continuance. And as all *Corrosions*, *Heats*, and *Stimulations*, such as Heat in making Water, Itchings any where, and such like are caused from Salts of any Kind too much exalted and from their other Adjuncts; whether, for Example, Spirit of Hartshorn or Salt Armoniac be freed from its Oils, or of Nitre from its watry Parts; the freer they are of these, the more violently pungent they are, and stimulate the more; but Water dilutes either, and added to them in a large Quantity, renders their Pungency abortive, and they will neither be tasted nor smelt: In like manner, if the Blood abounds with stimulating Salts, there is not a quicker nor a more effectual Method of relieving such Symptoms than by Dilution.

From its *sixth Property* of dissolving *watry Gums and viscous Bodies*, it appears how it destroys Cohesions, and of what Kind those Cohesions are which it can enter into; for we are to observe, that Cohesions are not all of one Species, some depend on Oils coagulated by Acids only, and such are best dissolved by alcalious Drugs; but in viscous Bodies Water is required: Hence in Jaundices produced by a Viscosity in the Lymph, and check'd in its passing through the Liver, Water is good, as a Vehicle to wash away and dissolve the *Coagulum*: In rheumatick or inflammatory Cafes, where a Size swims upon the Blood, the readiest way to get rid of this thick and viscous State is to use warm Water, it melts down in Water, but more especially in warm Water; it disjoins the Cohesions of the Particles, which unite into Grumes in the evanescent Vessels, and hinder the Passage of the Blood from the Heart to the Extremities, then ensue Inflammations, Pains, Fevers and Impostemation.

From its *seventh Property*, it may be an Instruction to us, how not only viscous, but also oily Bodies may be re-united to the Blood ; thus Gums of any Sort or Kind soever may be render'd fit for being blended, divided, and at last united with watry *Menstrua* : I could mention several notable Instances where this Mode of Union would come in play ; but I am not inclined to anticipate what will fall in more naturally hereafter : However, I must observe, that the Bile has been seen to swim upon the Serum unmix'd. Bile is the Oil of the Blood, and to blend these two, namely, the Choler and the Serum together, some intermediate Body, whether by way of Drug, as any fix'd or volatile Salt, or by way of Diet, as the Yolk of an Egg, become necessary, I shall supersede any further notice of this Affair.

By its *eighth Property* we learn how Water will wash away Earths from the Juices ; we know of no Earth whatever that does not yield to the Hammer, and therefore, if Water will not, its component Parts are harder than Earth, by which Property the Resistance of the Earth is overcome from the Nature of Resistances : If Earth sticks to the Vessels of the smaller Sort, Water washes the Channel, and digs it away ; this is usual in common Channels, that Earth, which sticks to the Walls of larger Pipes, is wash'd off if we lessen or straiten that Passage, these Cohesions then are best remedied in us as in ordinary Channels.

By its *ninth Property*, as it is not Elastick, suppose it to be under Motion, and another at Rest, which is Elastick, the Moment of a Quantity of Water equal to four Grains moved with a Velocity equal to three, is twelve ; if the Body at Rest is struck by it, then it will be, that from twelve we must subtract the Moment of the Body at Rest, which

which we will suppose to be six; now twelve and six equal to eighteen, divided by six and three equal to the Weights of the two Bodies, there will remain nine.

In short, where two Bodies of equal Gravity, and with equal Velocity, are moved contrariwise, or where their Gravities and Velocities are reciprocal, and they meet each other, there must be an intire Stop or Equilibrium.

By its *tenth Property*, we see how it contracts all solid and fluid Bodies into a narrower Compafs; how this is, or may be accounted for, is in vain to attempt. Cold and Pressure together do make Solids to retreat into a narrower Space; by this known Property we cure relax'd Fibres with Immersion; hence, in Palfies proceeding from a Relaxation of the Solids and nervous Tubes, plunging in cold Water has often succeeded, even after the nicest Methods had fail'd me; and this Advantage may be Mechanically accounted for, because, if a Fibre from three Lines Diameter of a given Length can be contracted into one Line, then it will do the same Feats with nine times less Space, and twenty-seven times less Matter: In this manner a stronger Action is perform'd with fewer Spirits; and thus it may be said, that plunging gives Spirits indirectly, inasmuch as it adds Strength, by making fewer necessary for the Performance of the Office of the nervous Fibres. By the same Force of contracting the Fibres, cold Water repels impacted Humours; and hence it is convenient in Tendons stretch'd beyond their usual Tone, or in Sprains: this is seen or tried by daily Experience; for if as soon as any Person has sprain'd a Sinew, let them plunge the Part immediately in cold Water; that is, before an Inflammation comes on, and let it stay

stay there for some time, repeat this plunging often, and all Accidents are prevented, that is, Pain, Inflammation, and perpetual Lameness. By this Property also, all the Fibres of our Body, if the Immersion be total and sudden, are contracted into a narrower Compas, so that the Vessels which held a large Quantity, will now hold less, or the Blood must be under a compress'd State ; if the Vessels are too full, then it follows, that it is dangerous to bathe before you empty these Vessels, for they being forc'd into a smaller Space, their Contents must either be highly compress'd, or they will burst with the Load ; hence Bleeding or Purging ought to precede Cold-bathing in full People ; the natural and fix'd Consequence of Bathing being a Contraction of the Fibres, and a Restitution of their elastick Tone ; the next Advantage is the Promotion of the Circulation, for the contractile Force becomes stronger, and the Channels narrower : The Effects of the first is perceiv'd in Bellows, and of the latter in Rivers at Bridges ; for with how much greater Force or Power Bellows are compress'd, the more strongly is the Stream of Air thrown out ; and by how much narrower a Channel becomes, whether made so by Nature, or by Arches and their Columns at Bridges, so much faster does the Stream move onward at that Point, because, as the same Quantity passes thro' in a less Time, the Velocity must be increased. These hydrostatical Experiments hold good, as far as Experience teaches us, in our Vessels ; and we are, as to the Animal Part of us, a regular Machine, acted upon and regulated by the Laws of Matter and Motion, as well as by the Qualities of Bodies that act upon our Fluids and Solids in no other manner within us than they do without us ; for Example, Oil of Vitriol applied to our Serum

or Blood, according to the Quantity, either congeals them, or quite corrodes them into a putrid Mass ; and they who have taken the Pains to inject these Fluids, do experience upon opening the Animals so poison'd, the Fact to be so ; and Experiments have proved, that volatile Spirits injected have attenuated the Juices, and swallowed with a plentiful Hand, have rarefied the Contents that a Fever and a violent Hemorrhage ensued ; and we all know what Effects this Oil has upon our Fibres, it corrodes them : Now if we will not be *Scepticks*, or in other Words stupid, and run counter to Reason and Sense, we need not be Empiricks, and be deaf and blind in Matters as visible as the Sun, and as audible as Thunder. Whether there be any such weak Set of Men in our Days, I am not follicitous on that Head, but surely if there are, it favours either of Ignorance or Design ; if of the first, they merit Contempt, for decrying useful Knowledge, and encouraging old Women ; if of the latter, the Experience of one Man is equal to another's ; and if he can shew me one cured by any paradoxical Method, I can produce him fifty destroyed by it.

As Water has an Effect upon our Solids, so also has it upon our Fluids, and if not too intense, it contracts them into a narrower Compafs ; hence when our Juices are too much rarefied, cold Water has a Power of quelling this Rarefaction : Now as our Blood may be highly rarefied, and as this Rarefaction produces various Consequences, so among those are the following, namely, *Watchings*. In Fevers, where the Blood bloats the smallest Capillaries, as appears by the Redness of the Cheeks and Veins of the Eyes; we must imagine that the Vessels of the Brain are also under the same State, as indeed it appears to be in Dissections of such Persons,

Persons, the vibrating Arteries at each Stroke jolt the Nerves, and give Uneasiness to them, which gives us Watchings, but also the Spirits are in such a Case separated in a strong Stream, so that Ideas are hurried upon us continually, and Sleep is banish'd from our Eyes; and as *Deliria* succeed Watchings, it must only be a continued Hurry, and a greater Degree of the same Cause that produces Ravings, for few watch much, but they become whimsical, and have rambling Thoughts. Bleeding takes off the Quantity of Blood, and so hinders the Effects of the Rarefaction, but Water compresses the Blood into a narrower Compafs, and hinders the Salts from uniting so closely, and at last allays the Struggle. All Ages have agreed in this, Reason is back'd with Experience, and the Vulgar are satisfied of the good Effects of watry Liquors in Watchings and Ravings.

I must here remark one Thing in relation to cold Water, that although it crispsates the Fibres at first, yet it relaxes the same at last; for it is not long in our Vessels till it becomes warm, and then it relaxes, as will be seen in the following Paragraph.

As Cold contracts our Solids and Fluids, so does warm Water relax our Fibres, and destroys Cohesions; from this known Property, Tumours that are hard are soften'd by a Fomentation of warm Water; it seldom appears that this is the whole Thing required for the Dissipation of a Tumour, but that one Intention of softning can't be better answer'd than by warm Water: By the same Property it promotes Labour; for if the Neck of the Womb or *Vagina* be too strait, a *Fotus* of warm Water relaxes the Parts, and makes way for the Foetus to pass through: In case of such an extraneous Body as the Stone sticking in

in the Kidneys, there is not a better Remedy to glib the Passages, than Water drank warm and plentifully, it washes off all Obstacles that lie in its way, and expels them.

It takes off all Cohesions, and destroys Coagulations in the Vessels ; hence in Rheumatick Pains, and other gross Bloods, it is a sovereign Remedy : If Water is not added, other Remedies cannot be conveyed to the Parts.

However, although Warmth be necessary for relaxing and diluting, yet too great Warmth crispates, and even destroys the Fibres and Blood ; what is it but Heat that makes Oil of Turpentine stop Bleeding, the Warmth or Fire in this Oil makes it caustick, and we experience how scalding Water flays us alive, and what Effects must we not expect from the swallowing it too warm, but Excoriations ?

By its *eleventh Property*, it keeps the Fluids in a due Consistence ; there is a certain Texture our Juices should have : if they are thicker than requisite, they must be diluted till they come to be of a due Thickness ; and all know how often the Blood grows viscid, so as to hurry on Dropsies themselves, which before the Vessels break, may be prevented by a due Proportion of Water : To this Sort of Dropsy Debauchees are subject, for Wines and spirituous Liquors drank with too plentiful a Hand carry off the just Quantity of Serum ; when the Blood grows too thick it stops in the smaller Vessels, which being press'd on from behind, tumefy and break, in such manner that the thinner Parts oufe into some Cavity, and cause a Dropsy. I say, before Matters are come to this Extremity, Water, or watry Liquors are very conducive to wash off this Cohesion, and to prevent a Dropsy, which, when bred, cannot admit

admit of such a Remedy ; for as before its *Genesis* it mingles with and divides the cohering Parts, so after it is begun, it would fill the Belly too much.

From its Property of *freezing*, we may know why such Blood as is loaden with too many watry Parts, makes many subject to dropsical Swellings in the Winter Season especially ; for in such a State the Fibres are always too much relaxed, they lose their elastick Tone, and do not return the Fluids quick enough, but leave them expos'd a long while to the open Air, by which Circumstance the Legs swell, the Fluids contain'd in such Vessels do freeze, and often stand still. The external Cold is so intense in the Northern Countries as to cause the Fluids to congeal and to stand still for ever, because many in those Countries die of Gangreens from this Reason ; nay, in our own Nation, plunging in cold Water, if continued too long at a time, will chill the Blood, and cause a Stagnation.

From the *Weight* of Water, we conclude it a proper Vehicle when the Blood is either compress'd or too dense ; it is observed to be too dense when too much Wine is drunk, not that Water is not heavier than Wine, but as Wine rarefies the Blood too much at first, and its thinner Parts fly off by its too frequent Repetition, therefore Water added thins it again, and makes it less dense.

Thus have we considered all the known Properties of Water, and taken it in all its Views, and given the Reasons for its Effects ; we shall now take it into Consideration in particular.

I know of no Preparation Water allows of ; that which is the clearest of Salt or of any extraneous Body is the most valuable ; and this must be

try'd by such as are skill'd in this Affair: In general, pour into Water Oil of Tartar or of Aniseeds, and if it grows muddy thereby, that is, if it grows whitish, it is a Sign of some Acidity in the Water; and the more muddy it grows, the more impure is the Water: We are apt not to expect any Water to be free from this Accident, some few excepted; and when you have made it muddy, you may clear it again with Spirit of Sulphur, or any Acid. This Acid in Water, as I have already made evident, proceeds from the common Salt that resides in all Water; and if we have a mind to rob Water of this Salt, we may distil it from a Glass-Still, for such distill'd Water does not grow muddy either with Salt of Tartar or Oil of Aniseeds, and such appears to be some *Italian* Water, especially that taken from the Conduit at *Pisa*.

Hence, that I may recapitulate the Virtues of Water; I say, it is good to *dilute* and *disgregate*, to *contract* or *dilute*, and to *dissolve* Bodies; hence does it cool our Blood, and help bilious Fevers as well as hot Scurvies, Bleedings, Head-aches, Itches, quenches Thirst, cures Debauches, quells hot Flatulencies, cures bilious Jaundices, hot Hypochondriacism, Pleuriticks, acid States, Deliria and Watchings: Hence also does it cure Prolapsus; hence it repels and contracts our Fibres. Hence, if warm, it dilates and relaxes, and by that Property mollifies hard Tumours. Hence it cures all stubborn Eruptions, such as the Elephantiasis itself. But hence is it dangerous where the stomachick Juice is deficient; hence is it bad in Stagnations, cold Constitutions, and in phlegmatick Cafes.

Pure Water then we have none, except the Distill'd, from Fountain or River Water, or from some

some watry or astringent Plants, which give out no volatile Parts, and even Ice thaw'd is a purer Water than Fountain, that is, it is more void of exotick Particles : however, for common Use Fountain Water is most agreeable, and although it does contain a small Portion of Salt, the Quantity is too inconsiderable to be regarded.

So much of Water.

The End of the FIRST VOLUME.



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